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STRUCTURAL CHANGES IN THE FOREIGN TRADE OF HUNGARY AND THE EUROPEAN UNION

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ABSTRACT
The spatial and industrial structure of foreign trade of the European Union and Hungary is the result of long development, which goes back several decades. The spatial structure of some industries were influenced by numerous factors (natural, social, economic and political) in recent decades, resulting in specific regional and sectoral structures in industrial trade in the meantime. In EU countries, including Hungary, the spatial and sectoral structure of industrial foreign trade had characteristic changes over the past 20 years. There are winners and losers of these spatial and sectoral transformations. Sometimes the import of some industrial sectors decreased; occasionally the export fell back, while in other industrial sectors the opposite happened. In order to observe and follow the changes of industrial foreign trade (spatial and structural) in the past few years, it is important to examine the transformation of spatial and sectoral industrial foreign trade structure of the European Union and Hungary during time.

Keywords: Hungary, European Union, foreign trade, industry, structure

INTRODUCTION

During the past few decades significant structural changes took place in Hungarian economy and in Hungarian industry. The main reason for these changes is that Hungarian economic relations from one day to the next one became west-oriented instead of being one-sidedly dependant on the East. Also, the majority of the industrial companies lost their previous markets, which caused difficulties in sale. This market-loss was followed by the deterioration of the often outdated and inefficient production capacity, factories closing down, privatization and highly increasing unemployment. To make matters worse the companies became insolvent, indebted, which resulted in severe liquidity problems (ABONYINÉ AND KOMAREK, 2005; BARTA, 2002; KISS, 2005; KOMAREK, 2011, 2012a).
The fact that the Comecon (CMEA) ceased to exist (September, 1991) and that Hungary became the associate member of the EU (December, 1991, had a major part in the structural changes of our industry. It meant a serious challenge to Hungary's economy and through that to the industry, because it had to become flexible and adapt to new market conditions in a very short time. The expectations of the new (primarily Western European) markets were much more demanding than in the former socialist countries. That is why companies had to meet the demands of more and more technological and technical standards, beside improving and upgrading their technology. As a result, the foreign relations of Hungary were favourable and, concerning industrial sales, were increasingly turning to the developed countries. As a result, in the 1990s, a significant proportion of export and import was conducted with developed countries and within that with the European Union member states, the role of which was growing in the foreign trade of our country (KISS, 2010; KOMAREK, 2012b, 2012c).

MATERIAL AND METHOD

Over the past two decades, the industrial foreign trade of our country and the European Union had major structural and spatial changes. These changes required studies to investigate whether there are any changes in the spatial organization of industrial foreign trade and whether there are characteristically increasing or decreasing industrial sectors in foreign trade. I processed the available data of the Hungarian Central Statistical Office (KSH) and EUROSTAT. The comparative analysis was carried out and the conclusions were made by the mathematical and statistical methods used in regional researches.

RESULTS

After the regime change our most significant foreign trade partner was the united Germany with 27.7% of our export, while 23.5% of our import- in 1992. I changed during the years and by 2001 it was 35.6% of our export and 24.9% of our import that was done with Germany. The high proportion at the beginning of the 90' was partly due to the fact that the former German Democratic Republic used to be the second largest trade partner of Hungary, following the Soviet Union, before the regime change. From 1990 on, however, the economic and foreign trade relations with the former East German provinces gradually ceased, and as a result today the German partners of Hungarian industry are in South-Germany (Bavaria and Baden-Württemberg).

Table 1. Hungarian industrial exports by country-groups (%)

Year	Developed countries	Within the Developed Countries		Developing countries
		EU	Central- and Eastern-European Countries	
1992	71.2	49.8	23.0	5.8
1996	69.8	62.7	23.5	6.7
2001	82.4	74.3	14.0	3.6

Source: Author's calculations based on KSH data

Table 2. Hungarian industrial import by country-groups (%)

Year	Developed countries	Within the Developed Countries		Developing countries
		EU	Central- and Eastern-European Countries	
1992	69.7	42.7	24.8	5.5
1996	68.9	59.8	23.9	7.2
2001	69.4	57.8	16.6	14.0

Source: Author's calculations based on KSH data

Out of the countries of the previous "socialist block" it was the Commonwealth of Independent States (CIS) formed after the Soviet Union ceased to exist, that played a major part in Hungarian foreign trade in the years following the regime change.[1] 13.1% of our industrial export was carried out with CIS countries and at the same time 16.9% of our

[1] This international organisation and association comprising 11 member states of the former Soviet Union was founded in December 1991 with the goal of economic, military and foreign policy cooperation. There are 9 permanent and two associate members.

import came from there in 1992. By 2001 our foreign trade with CIS countries fell back considerably. Out of these countries our major partner is Russia, from where 7.0% of our industrial import is received, while only 1.5% of our export goes to Russian market. The considerable Russian market can be considered as a reserve not utilized yet, therefore it would be wise to strengthen our foreign trade relations.

As far as the European countries are concerned, important economic (foreign trade) relations started with the neighbour countries of Hungary. Out of these countries it is Austria that can be primarily highlighted, since it was the third most important foreign trade partner in the field of industry at the beginning of the 1990s. Austria had a 10.7% share of our total export in 1992. At the same time 14.4 % of Hungarian import came from Austria. By 2001, however, both export (7.9%) and import (7.4%) decreased compared to that of the previous years. This was mainly due to the fact that the sectoral structure of the industries of the two countries became similar during the time.

Out of the founder countries of the European Union it was Italy that played an important part in the foreign trade of Hungary. In 1992 the share of Italy from our total export was 9.5%, while from our total import it was 6.3%. By 2001 a decrease can be observed in the field of export (6.3%) and an increase in import (7.8%). Out of the other EU countries France, The United Kingdom, Belgium and the Netherlands can be mentioned. In case of each of these countries the industrial export and import has a share of 2.0 to 4.0%.

Considering the Central-Eastern European countries our former intensive foreign trade relations fell back. In the early 1990s it was the Czech Republic, Slovakia, Romania and Poland that we had significant trade with. By 2001, however, each of the Central-Eastern European countries had a share of 1 to 3.0% in our industrial export and import.

Table 3. Hungarian industrial import by country-groups (%)

Year	European Union		Countries outside the European Union		Out of the non EU countries			
					Asian		American	
	Import	Export	Import	Export	Import	Export	Import	Export
2004[1]	71.7	79.5	28.3	20.5	14.5	4.4	2.2	3.6
2006	67.9	74.3	32.1	25.7	15.8	5.3	2.1	3.4
2008[2]	68.3	78.3	31.7	21.7	16.0	5.1	2.4	3.0
2010	67.8	77.4	32.2	22.6	18.4	6.5	2.5	3.0

[1]From 2004: EU-25
[2]From 2008: EU-27
Source: Author's calculations based on KSH data

The role of export in the foreign trade with Asian and developing countries also fell back during the 90s. At the same time the significance of import had a threefold increase by 2001, compared to 1992. The increase was particularly due to Japan (4.6%), China (4.0%), Singapore (1.5%), Taiwan (1.4%), Malaysia (1.4%) and South Korea (1.2%). These Asian countries gave 14.1% of our total import in 2001.

Out of the overseas countries it is the United States of America that must be mentioned, since our economic relations gradually deepened with them. In 2001 the USA had 4.9% share of our total export, while 4.2% of Hungarian import arrived from there.

After the Hungarian EU accession the orientation of the foreign trade of our country did not change considerably compared to that of the previous years. It means that the European Union member countries still have a major part in our foreign trade. Out of the former EU-15 the most significant countries are Germany, Austria, Italy, the Netherlands and France.

As far as the industrial export is concerned, in 2004 Germany had 31.6%, Austria 7.3%, France 5.6%, Italy 5.5% and the Netherlands 3.7% share of the total. At the same time the export shares were as follows: Germany 29.3%, Austria 8.1%, Italy 5.6%, the Netherlands 4.9% and France 4.6%.

By 2010 smaller changes took place in the field of industrial foreign trade. Some countries lost their importance, while others increased their advantage. The export shares of Hungary were given by Germany 25.1%, Italy 5.5%, the United Kingdom 5.4%, France 5.0% and Austria 4.9%. In case of import it is Germany (24.0%), Austria (6.2%), the Netherlands (4.5%), Italy (4.3%) and France (3.7%) that can be highlighted.

Hungary has remarkable foreign trade relations with several of the former Comecon (CMEA) countries, namely the Czech Republic, Slovakia, Poland, and Romania. In 2004 Romania had 3.2%, Poland 2.9%, the Czech Republic 2.4% and Slovakia 1.9% of the total Hungarian export. Concerning our import, 3.2% was from Poland, 2.8% from the Czech Republic, 2.0% from Slovakia and 1.5% from Romania. By 2010 it is apparent that the shares of the given countries in our total export increased as compared to those of 2004. As a result, the shares were as follows: Romania 5.4%, Slovakia 5.3%, Poland 3.7% and the Czech Republic 3.5%. An increase in import can be observed as well. 5.3 % of our import was from Poland, 4.2% from Slovakia, 3.2% the Czech Republic and 2.6% from Romania. Expanding and deepening the foreign trade relationships with neighbouring countries should be encouraged.

Out of the Asian countries it is Japan, China and South Korea that can be mentioned. Our foreign trade balance with these countries is negative. 4.8% of our import was from China, 3.0% from Japan and 1.5% South Korea in 2004. By 2010 there was an increase in case of China (7.1%) and South Korea (3.3%), while the share of Japan decreased (2.2%). Our export to these countries in the examined period often did not reach even 1.0%. We must endeavour to shift our foreign trade balance to a positive direction.

Out of the former Soviet states it is Russia that can be mentioned. In 2004 the Russian share of our import was 5.7%, and that of our export was 1.6%. By 2010 both the import and the export increased somewhat, up to 7.8% and 3.6%, respectively.

Considering the overseas countries we have remarkable foreign trade relations with the United States. In 2004 the share of the USA from our industrial export was 3.0%, and from our import 1.7%, while in 2010 it was 2.0% and 1.8%, respectively.

The above mentioned facts show that by the turn of the century the foreign trade of Hungary in the field of industry became significantly EU-centred. In the past decade our EU-centred foreign trade deepened. It is supported by the fact that the EU market has an approximately 80.0% share of our industrial export and 70.0% of our import is also from the countries of the European Union. All this results in a significant dependence, which, in case of recession, might have a negative effect on Hungarian economy and within that the spatial and sectoral structure of our industry. However, the strong market dependence also has positive results, which reflects the fact that our products meet the needs of the European Union's stringent quality, technical and technological requirements. However, it is unfortunate that the economy of a country and within that the orientation of their foreign trade is so one-sided in the ever-changing world. It would be useful to regain some of the former Eastern markets and expand, strengthen our relationships with countries, mainly Asian, North and Latin American countries, which can be suitable market for our products. It could lessen our dependence on the European Union and some specific countries within that, and it could contribute to forming multi-pole foreign trade relations.

The changes in the orientation of Hungarian foreign relations resulted in the spatial and sectoral structure of our industry.

Previously our industry (in the CMEA period) was very significantly specialized in mechanical engineering, in the manufacture of road vehicles (buses), which meant that the *Ikarus* bus produced in Hungary reached all parts of the former "socialist world".
After the regime change in the early 90s, in terms of the sectoral structure of our exports it was found that the raw materials and semi-finished products as well as food and food ingredients sold in 1990 accounted for 61.0% of our exports, while in 1994 it was 57.1% of the total. By 2000, the machinery and equipment export alone accounted for 60.0% of our total exports, although it played a minor role previously. In contrast, the raw materials and semi-finished products as well as food and food ingredients significantly lost their previous better situation. The reason for that is that companies do not export their products in form of raw material or ingredients; they sell them as finished products. In the first half of the 90s raw materials and semi-finished products accounted for 46.3% of our imports, while machinery and equipment had a share of 17.7%. By 2000 the ratio of raw materials and semi-finished products significantly fell back (26.4%), in contrast the role and importance of machinery and equipment increased significantly (51.5%).

Table 4. Hungarian foreign trade by product-groups 1990-2000 (%)

Name	1990		1994		2000	
	Import	Export	Import	Export	Import	Export
Fuels	13.8	2.4	11.0	3.3	8.3	1.8
Raw materials and semi-finished products	46.3	37.9	36.8	36.5	26.4	19.2
Machine, equipment	17.7	20.1	23.4	13.0	51.5	60.0
Industrial consumer goods	14.6	16.5	22.0	26.6	11.1	12.1
Food and raw materials for food industry	7.6	23.1	6.8	20.6	2.7	6.9
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Author's calculations based on KSH data

The import and export typical in Hungarian foreign trade trends require a separate analysis for the years 2001 and 2010 because of the changes in the composition of foreign trade within the industrial groups. In 2001, a significant proportion of export, 57.6% of the total, was of machinery and transport equipment, while processed products had a share of 31.0%. By 2010 the proportion of machinery and transport equipment further increased (60.2%), while that of the processed products decreased (27.6%). The main sectors contributing to exports were machinery and transport equipment (51.6%), and processed products (35.3%), similarly to imports. The previous two product-group lost some of their importance, at the same time the food, beverages, tobacco product group had a slight increase in the examined period compared to the base year.

Table 5. Hungarian foreign trade by product-groups 2001-2010 (%)

Name	2001		2005		2010	
	Import	Export	Import	Export	Import	Export
Food, beverages, tobacco	2.9	7.5	4.1	5.8	5.0	6.9
Raw materials	2.0	2.0	1.8	2.0	2.1	2.4
Fuels	8.2	1.9	10.2	2.7	10.7	2.8
Processed goods	35.3	31.0	32.8	27.6	31.9	27.6
Machines and vehicles	51.6	57.6	51.1	61.9	50.3	60.2
Total	100.0	100.0	100.0	100.0	100.0	100.0

Source: Author's calculations based on KSH data

The foreign trade structure of Hungarian industry that developed during the years is in conformity with the industrial structure of the European Union.

Table 6. The sectoral structure of the foreign trade of processing industry in the European Union (EU-15) (%)

Industry	Export		Import	
	1991	2001	1991	2001
Food, beverages, tobacco production	7.6	5.3	7.2	5.0
Textile, textile clothes production	5.7	4.7	10.7	8.8
Leather, leather goods, footwear production	1.7	1.6	2.3	2.2
Wood and wooden product manufacturing	0.6	0.8	1.9	1.4
Cellulose, paper goods, printing	3.2	2.8	2.6	2.1
Coke and crude oil production	2.0	1.9	4.4	2.8
Chemicals production	13.1	14.7	9.5	9.8
Rubber and plastic production	2.3	2.5	1.9	2.2
Other non-metallic mineral products	2.3	1.9	1.0	1.2
Metal raw material and metal commodity production	9.2	7.0	9.5	8.8
Machine and equipment production	18.1	14.9	8.2	8.3
Electronic and optical products	14.3	20.4	23.5	28.6
Vehicle production	16.0	18.4	12.8	14.4
Other processing industries	4.0	3.3	4.3	4.4
Total	100.0	100.0	100.0	100.0

Source: Author's calculations based on EUROSTAT data

On examining the sector structure of the foreign trade of the European Union (EU-15) we can see that machine and equipment production, vehicle production as well as electronic and optical products had importance in the field of export sales in 1991. The majority of the products was sold to the United States of America, Switzerland, while a somewhat smaller part to Japan, the former Soviet Union and Norway. Considering the import it was the vehicle production, the electronic and optical products, and textile, textile clothes production that had priority. The products of the given sectors were brought in from the United States of America, Japan, Switzerland, China and Taiwan.

During a decade there were no significant changes in the export structure of the EU 15 member states. In 2001 also it was the electronic and optical products, vehicle production and machine and equipment production that had a 53.7% share of the export. These

products were primarily sold to the markets of the USA, Switzerland, Japan, Poland and China. By 2001 as compared to 1991, the electronic and optical products as well as the vehicle production had a larger share from the import, at the same time the textile and textile clothes production lost from its importance. Concerning the import it was the chemicals production that got forward in the ranking. 53.1% of the total imported products are from the United States of America, Japan, China, Switzerland, the Czech Republic and Hungary.

The European Union had new member states in 2004 however no significant changes took place in the export structure. This means that the export structure of the accession countries is considerably similar to the former EU-15 sectoral structure. As for the exports in 2004 the electronic and optical products, chemical production and the vehicle industry were in leading position. Considering imports it is also the electronic and optical products, vehicle production and chemical products that are dominant. The U.S., Switzerland, China, Japan and Russia have a major role both in exports and imports.

The expansion of the EU to 27 members did not result in significant changes in the structure of external trade. As far as exports are concerned, chemicals production, vehicle production as well as electronic and optical products were dominant in 2006 and 2007. In case of import the decisive sectors were electricity, gas, steam and water supply, electronic and optical products manufacturing and chemical industries in 2006, while in 2007 it was mining and quarrying, electronic and optical products as well as chemical products. The share of the United States of America, Switzerland, China, Russia, Japan, and Turkey is significant both in exports and imports. Today, when examining the structure of the sectors it was found that in the foreign trade of the 27 member states of the European Union it was machinery and transport equipment that played a leading role. Main foreign trade partners are the United States, China, Russia, Japan, Norway, Switzerland and Turkey.

Table 7. The sectoral structure of the foreign trade of processing industry in the European Union (EU-27) (%)

Industry	Export		Import	
	2008	2011	2008	2011
Food, beverages, tobacco	6.4	6.9	5.6	6.0
Raw materials	2.2	2.6	4.7	5.1
Fuels	5.1	5.5	24.6	24.3
Chemicals and similar products	1.1	16.7	9.3	10.2
Machines and vehicles	43.2	41.0	29.9	28.6
Other processed goods	25.1	24.4	24.2	24.1
Other product and transaction not specified elsewhere	2.9	2.9	1.7	1.7
Total	100.0	100.0	100.0	100.0

Source: Author's calculations based on EUROSTAT data

CONCLUSIONS

In recent years, due to changes in the market conditions in our country and in some countries of the European Union major changes took place in the structure of industry. The changes resulted in new spatial and sector structure in foreign trade as well. One main feature of the industrial structure changes both in Hungary and in EU is the fact that the traditional industries that are continuously losing their importance and the new ones taking up the challenges of the economy and the market are present in the sector structure.

The importance of the traditional sectors within the industrial foreign trade decreased, while that of the dynamically developing industrial sectors keeps growing. There are several reasons for the decrease, among them the fall-back in demand as well as raw material resources, the increasing costs or production, the growing international competition on global market, and also the continuous improvement of science and technology. Concerning the added value, the declining sectors are (in the European Union as well) mining, certain sub-sectors of metallurgy (e.g. manufacturing electrical appliances, shipbuilding), the textile, leather products and footwear production, while the dynamically developing sectors include information technology, electronic and optical products, vehicle production and some sub-sectors of chemical industry (pharmaceutical production, chemicals and chemical products).

Overall, we can say that the most important industrial sectors in the countries of the European Union involve declining, moderately growing and dynamically developing industries as well. In 25 former member states of the European Union 25 member states of the role of the five former industries can be highlighted: the basic metals and fabricated metal products, vehicle manufacturing, the production of electronic and optical products, chemicals and food, beverages and tobacco production. These industries have a significant proportion of industrial output and employment. With the European Union expanding, the position in these industrial sectors continued to grow because these sectors also play an important role in the industry of the accession countries (Bulgaria and Romania).

The existing differences between the industrial structures of the old and the new member states can be characterized that in case of the old ones knowledge-based sectors (such as engineering or chemical production) are dominating, while in the new ones it is usually the working industries (e.g. textile industry). The industrial structure of manufacturing in each member state is somewhat different from that of the European Union as a whole. Considering added value, the largest industries in the former 15 member states of the EU are the machinery and equipment manufacturing, food, beverage and tobacco manufacturing and chemical industries. However, some regional differences can be seen. Among the founding members of the European Union stands out the chemical industry in the Benelux countries (Belgium), food, beverages and tobacco production (Netherlands), and last but not least, basic metals production (Luxembourg). For France, the food, beverages and tobacco, while Germany and Italy the machinery and equipment manufacturing.

As for the countries connecting later, in Denmark, Greece, Spain, Portugal and in the United Kingdom, the food, beverages and tobacco industry is dominant, in Ireland it is chemicals, in Austria the machine and equipment manufacturing, in Finland, telecommunication products manufacturing, while in Sweden, the vehicle production is the largest and most significant industry, which is also reflected in the field of foreign trade.

In the expanding European Union there were small changes concerning added value. In the former 15-member economic integration the three major industries were machine and equipment manufacturing, food, beverage and tobacco production and chemical industries. Among the new member countries (2004), in the Czech Republic, the Baltic States, Hungary, Poland and Slovakia, the electricity, gas and water supply sector is the most important. In Cyprus food, beverages and tobacco production, in Malta, the telecommunication products, in Slovenia, fabricated metal products can be highlighted. However, considering the EU-25, the three main industrial sectors are still the food, beverages and tobacco, chemicals, and machinery and equipment manufacturing sectors.

The accession of other countries to the European Union might create a new situation in the development of both the industry and the foreign trade of the economic integration. Consequently, the spatial and structural changes affecting industry and through that foreign

trade have not ended yet, as both the spatial and structural changes are the results of long development.

REFERENCES

ABONYINÉ PALOTÁS JOLÁN, KOMAREK LEVENTE (2005): Jegyzet Magyarország társadalomföldrajza tanulmányozásához. JATEPress, Szeged. 190. p.

BARTA GYÖRGYI (2002): A magyar ipar területi folyamatai 1945-2000. Dialóg-Campus Kiadó, Budapest-Pécs. 272. p.

KISS ÉVA (2005): Az Európai Unió a XXI. század elején. Akadémiai Kiadó, Budapest. 462. p.

KISS ÉVA (2010): Területi szerkezetváltás a magyar iparban 1989 után. Dialóg-Campus Kiadó, Budapest-Pécs. 223. p.

KOMAREK LEVENTE (2011): A magyar ipar főbb sajátosságai az abszolút specializáció tükrében. Jelenkori Társadalmi és Gazdasági Folyamatok 6(1-2): 28-34.

KOMAREK LEVENTE (2012a): A magyar ipar területi specializációja a belföldi és az export értékesítés tükrében. A Földrajz Tanítása 20(3): 30-42.

KOMAREK LEVENTE (2012b): The absolute specialisation of Hungarian industry with regard to regional export. Review on Agriculture and Rural Development 1(1): 50-55.

KOMAREK LEVENTE (2012c): The features of the macro level absolute concentration of Hungarian industry. Review on Agriculture and Rural Development 1(2): 519-524.

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THE POSSIBILITIES OF ORGANIC SHEEP AND GOAT PRODUCTION IN SERBIA

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ABSTRACT
Basic principles that inform organic livestock production are reviewed in this paper, with special emphasis on sheep and goat organic farming in Serbia and provide guidance for development in the future. It also discusses the challenges of the modern age that may affect the viability of sheep and goat production. Today in Serbia grow less than 1.5 million sheep. In terms of breed structures, most of the population makes indigenous Pramenka sheep (80%), while the remaining 20% are: Tsigai, Merinolandschaf, Ile de France, Pirot improved, and other less important populations, as well as the crossbreeds with foreign and local domestic sheep. The most popular goat breeds are: balkan goat, domestic white as autochthonous breeds, as well as the Sanental, Alpen and Toggenburg breeds. Genetic improvement is significantly increased level of production of all species of domestic animals. However, native animals selected for high and efficient production are exposed to greater risk. This primarily refers to the physiological and immunological problems, but would generally be said that all this leads to distortion of harmony between the organism and the environment and the repercussions on the molecular level. Sustainable development of sheep and goat breeding in Serbia must be kept in mind. Possibilities for further development of organic sheep and goat production are great, and it can be expected that it will increase in the future and can become a significant branch of livestock production.

Keywords: sheep, goat, organic farming, autochthonous breeds

INTRODUCTION

Organic livestock farming needs a balance between ecology and economy. Organic husbandry like ecological sheep and goat production are a new possibility for livestock production in Serbia (KÖNYVES ET AL., 2013). Marketing of produced animal originated products became more popular, and it is organized by farmers themselves or by their associations (BENNETH, 1996; BADERTSCHER-FAWAT ET AL., 1998.) First organic production in Serbia has started in the late 70's. For the last ten years, production and processing of organic products became more popular and economically more important (PETROVIC ET AL., 2011). Serbia does not have central database system and is hard to give precise figures about the size of organic production. According to the official data from the certified agents, organic production is currently conducted on around 1,200 ha. But, according to the unofficial data from the agents that are not certified by the Ministry of Agriculture, organic production in Serbia is currently conducted on much larger area of about 5,000 ha; while additional 9,000 ha of land is still in the period of transition towards organic production. That makes a total organic production of some 14,000 ha or only 0.3% of the total arable land of 4.2 million ha that is available in Serbia (GRDOVIC ET AL., 2011). The total number of registered organic farmers in Serbia is 218. Organic development in Serbia is driven by export. The "rule of 30%" in organic production means that farm animals kept in organic system must ingest at least 30% of meal dry matter from pastures, makes forage quality of highest importance. Serbia has a potential for growth of this sector,

but mainly in rural areas where conventional production is not possible or sources of pollution are not nearby.

Sheep and goat breeding is an important area of the economy, because this turnout get valued products, even those using the natural resources where human feet rarely goes down. Integrating sheep and goat into a farming operation can contribute to the economic and environmental sustainability of the whole farm (WELLS ET AL., 2000; MASON, 2003). The relatively small investment required, and the gradually increasing size of the flock, make sheep and goat production a good choice for the beginning small-scale or part-time farmer for the established farmer seeking to diversify, sheep offer a number of benefits. Sustainable sheep and goat farming is a way to get high quality meat, milk and wool, while preserving the environment, respect for labor and welfare in order to achieve economic gains and increased social status of farmers for sustainable production in today's conditions, it is necessary to know a number of biological, technological, organizational and market factors (PETROVIC, 2007). If farmers want to increase their production and profit, they need to apply modern methods of selection. For success in sustainable animal production many factors have an impact: effectiveness of controls and recording production characteristics, evaluation of genetic parameters and value of animals and organization of the diffusion of genetic material.

Sheep and goat are a significant sector of livestock production in Serbia especially in the mountainous area, which has significant natural resources (PETROVIC ET AL., 2010). Out of 826,834 ha of grassland and 601,152 ha meadow in Serbia, about 86% are located in mountain area where is about 50% of the rural population. The aim of this paper is to review the status of sheep and goat production in Serbia and point to the possibility of sustainable development in the future.

THE IMPORTANCE OF AUTOCHTHONOUS BREEDS IN ORGANIC LIVESTOCK MANAGEMENT

Most recently, autochthonous breeds have been recognized as important elements to regional agro-biodiversity and, more specifically, in their relevance to agro-ecosystems that encompass the cultural heritage of a given region. By recognizing that locally adapted animal breeds have gained genetic resistance and adaptability through the evolutionary process, breeding strategies in sustainable and organic farming practices today are far more attuned to the necessity for preserving and utilizing these autochthonous breeds. Locally adapted breeds can promote sustainable development, reduce production costs, and prevent genetic pollution of a region's biodiversity. The significance of autochthonous breeds is especially stressed in the production of organic meat. To this point, advertising campaigns regularly deliver messages that highlight autochthonous, indigenous breeds, which is not only scientifically accurate from the aspect of environmental adaptation, but most importantly, builds consumer confidence in domestic products.

ORGANIC GOAT PRODUCTION

Present status of Serbian organic goat breeding is not favourable since the number of goats used in the production of milk and meat is relatively low and sufficient only for meeting the demand on the domestic market. The negative trend in the number of goats has been present for over three decades and it is anticipated that it will continue in the future. The situation is considerably aggravated by the large number of non-commercial

holdings/households with mainly older population, without any modern equipment, lack of motivation for this production, where it is difficult or impossible to organize high quality production, or make long term production plans. Organic goat production is mainly present in hilly-mountainous regions, less economically developed areas with modest or poor food sources. There is difference in the number of goats reared in different regions, starting from areas where they are very rare, to those where they are considerably more numerous. They are reared mainly by poor households from passive regions or those without sufficient food for cows, to use goats as animal of very modest requirements to produce valuable foodstuff to satisfy their needs (*Table 1*). Interest of individual holdings/farms for goat rearing is constantly increasing. Goats are reared mainly on individual agricultural households, usually 1 to 2 animals, although in the field there are breeders with 20, 30, 50 and more goats in rearing.

In regard to the breed structure, the least represented are goats of Alpine breed – approx. 2-3%, White Serbian goat - 15%, different types of crosses – approx. 35% same as goats of low land Balkan type and approx. 12% of high land Balkan type. Based on results of scientific studies on goat rearing – phenotypic and production data, generally, in Republic of Serbia (ZUJOVIĆ ET AL., 1983, 1984, 2000, 2001, 2002; MEMISI, 2000) most goats represent a product of various mutual crossing of Balkan goat of low and high land type, as well as their crossing with different types of crosses with Saanen breed. Domestic white goats, especially short haired animals, are different types of crosses of Domestic White goat and Saanen goat, i.e. increase of their number in certain way caused increase of number of dairy goats on account of Domestic Balkan goats. In the organic goat milk production the mentioned native breeds are most rife.

Table 1. Average values for productivity of goats according to genotypes in 2010 on individual farms

Genotype	Body mass of adult animals (kg)	Fertility (%)	Lactation (days)	Milk (kg)	Average Daily Yield of Milk (kg)	Body mass of kids (kg)		
						At birth	At 30 days	At weaning
Alpine goat	49.92	1.60	215	465	2.16	2.85	8.88	18.58
Serbian White goat	46.22	1.57	212	370	1.74	2.63	6.38	13.43
Balkan goat	43.39	1.35	209	187	0.89	2.38	6.60	13.42

ORGANIC SHEEP PRODUCTION

Over 90% of the sheep in Serbia is concentrated in small breeders, with the variable structure and size of the herd. In the last twenty years we have seen a change in the numbers of sheep, as *Table 2* shows.

Table 2. The number of sheep in Serbia (1000 individuals)

Year	1990	2000	2005	2006	2007	2008	2010	2012
Number of sheep	2.127	1.611	1.576	1.556	1.606	1.605	1.475	1.729
Index	100	76	74	73	75	75	69	81

From the above table we can see that the number of sheep in the past two decades fell by about 30%. The greatest reduction in the number of sheep registered in the nineties. After

stabilization, a large decrease in the number of sheep was followed by the year 2010 and by 6% compared to the year 2008. Thus, today in Serbia grow less than 1.5 million sheep. In terms of breed structures, most of the population makes indigenous Pramenka sheep (80%), while the remaining 20% are: Tsigai, Merinolandschaf, Ile de France, Pirot improved and other less important populations, as well as the crossbreeds with foreign and domestic sheep. In Serbia sheep production, for the last few decades, there have been certain changes in the system of breeding. The conditions of keeping, feeding and care improved. There were also foreign breeds imported, and some of them adapted to new conditions, and they are grown in pure breed. Genetic improvement of sheep in Serbia is carried out in accordance with the breeding program. This program covers the most important breed of sheep that are of national interest. The most important average production parameters of the population covered by the breeding program are given in *Table 3.*

Table 3. Average (LSM±SE) values and production traits of sheep breeds in Serbia (PETROVIC ET AL., 2010)

Breed of sheep	Fertility (%)	Body weight of lamb (kg)			Weight of adult animal (kg)	Yield of wool (kg)
		1. day	30. day	90. day		
Merinolandschaf	118	3.83±0.13	12.89±0.34	28.78±0.99	57.13±2.41	3.31±0.05
Pirot improved	127	3.17±0.10	11.86±0.40	24.22±1.01	59.13±2.86	2.58±0.07
Ile de France	132	4.61±0.16	14.94±0.33	33.96±0.90	69.57±2.99	3.87±0.06
Sjenica Pramenka	129	3.09±0.09	11.82±0.42	21.16±0.95	57.98±2.11	2.32±0.04
Svrljiska Pramenka	133	3.38±0.11	10.56±0.31	26.66±0.98	54.53±2.13	2.82±0.09
Lipska Pramenka	127	3.90±0.14	13.61±0.38	28.57±0.96	62.48±2.27	3.51±0.06
Krivovirska pramenka	140	3.36±0.10	8.70±0.28	20.70±1.03	54.80±2.17	2.33±0.03

CHALLENGES AND RISKS IN SUSTAINABLE SHEEP PRODUCTION

New challenges facing the sheep breeding of Serbia, stems from a political orientation toward membership in the European Union (PETROVIC, 2005). New conditions for agriculture of the Republic of Serbia shall be established and reflected in the transition from centrally planned economies, where the greatest responsibility on the state apparatus, to a market where the center of the responsibility of the individual. The new integration processes (the WTO and the EU) will further change the economic conditions that will be reflected in the liberalization of agriculture, and therefore require even greater competitiveness. Increasing competitiveness is reflected in rising living standards over time and it can increase investment both in equipment and new technologies and investments in knowledge. This implies that the sheep breeding, the structure of farms, quality standards, marketing, education and training must be improved. Only by increasing the competitiveness of farmers from the Republic of Serbia can survive and thrive in the highly competitive EU internal market.

Sustainable access to sheep production in Serbia and agriculture in general, seeks to strengthen family farms, protect and exploit natural resources. This can provide a good farmers' profit, improve the efficiency of the genetic potential of sheep and perform the restoration of natural and economic resources for future generations. With these goals in

mind, the sustainable production of cheap food for sheep, controlled grazing, integrated management of diseases are necessary steps in this way. Many small farmers that are dominant in Serbia need to increase economical viability and find alternative marketing strategies, including the fostering of local or regional markets. Based on the fact that Serbia has about 1.5 million sheep and preserved natural environment, there are preconditions for successful development of sustainable sheep and avoid the risks of such negative effects of modern technology.

REFERENCES

BADERTSCHER-FAWAZ, R., JÖRIN, R., RIEDER, P. (1998): Einstellungen zu Tierschutzfragen: Wirkungen auf den Fleischkonsum. Agrarwirtschaft 47: 107–113.

BENNETH, R.M. (1996): Willingness-to-pay measures of public support for farm animal welfare legislation. Vet. Rec. 139: 320–321.

GRDOVIĆ S., VITOROVIĆ G., PETRUJKIĆ B., MITROVIĆ B., NEDELJKOVIĆ J., TRAILOVIĆ S. (2011): Possibilities of organic production in Vojvodina. Biotechnology in Animal Husbandry 27(3): 1357-1365. ISSN 1450-9156.

MASON J. (2003): Sustainable Agriculture. Landlinks Press. 208 p.

MEMIŠI N. (2000): Kvantitativna analiza telesne razvijenosti i proizvodnih osobina domaće balkanske koze. Doktorska disertacija, Poljoprivredni fakultet, Beograd-Zemun. 168 p.

PETROVIC, P.M. (2007): Sustainable sheep breeding. Institute for Animal Husbandry, Belgrade. 256 p.

PETROVIĆ, M.M. (2005): Livestock production in Serbia on way to European Union. Biotehnology in Animal Husbandry 21(5-6): 1-8.

PETROVIC, M.P., PETROVIC, M.M., RUZIC-MUSLIC, D., CARO PETROVIC, V., MAKSIMOVIC, N., ILIC, Z., VUCKOVIC, S. (2011): Opportunities and challenges for Sustainable sheep production in Serbia Biotechnology in Animal Husbandry 27(3): 463-472. ISSN 1450-9156.

PETROVIC, M.P., RUŽIC-MUSLIC, D., ALEKSIC, S., MAKSIMOVIC, N. (2010): Investigation of production traits of the most important sheep breeds in Serbia. Journal of Mountain Agriculture on the Balkans 13(2): 356-366.

KÖNYVES, T., MISCEVIC B., ZLATKOVIC, N., LENGYEL, L., BOSKOVIC J., IVANC, A., SUTUROVIC, E. (2013): The possibilities of organic farming in Vojvodina. Review on Agriculture and Rural Development 2supplement: 320 – 324. ISSN: 2063-4803.

Wells, A., Gegner, L., Earles, R. (2000): Sustainable sheep production. Livestock Production Guide. Appropriate Technology Transfer for Rural Areas (ATTRA). 12 p. http://www.attra.org/attra-pub/sheep.html.

ŽUJOVIĆ, M., JOSIPOVIĆ, S. (1983): Uticaj telesne mase jaradi pred klanje na prinos i kvalitet mesa. VII jugoslovensko savetovanje »Kvalitet mesa I standardizacija«, Bled. Zbornik referata pp. 319-332.

ŽUJOVIĆ, M., JOSIPOVIČ, S., CERANIĆ, V. (1984): Značaj i osobine jarećeg mesa. VII jugoslovensko savetovanje, Banja Koviljača. Savremena poljoprivreda 299: 65-67.

ŽUJOVIĆ, M., JOSIPOVIĆ, S., GLUHOVIĆ, M., STRSOGLAVEC, S., TOMAŠEVIĆ, D. (2000): Telesna masa jaradi domaće bele koze pred klanje kao faktor prinosa i kvaliteta mesa. Journal of Scientific Agricultural Research »Arhiv za poljoprivredne nauke 61(3): 113-121.

ŽUJOVIĆ, M., PETROVIĆ, P.M., DJORDJEVIĆ-MILOŠEVIĆ, S., GLUHOVIĆ, M., STRSOGLAVEC, S. (2001): Perspektiva ovčarskih i kozarskih domaćinstava u novom milenijumu. Savremena poljoprivreda, 50(3-4): 337-341.

ŽUJOVIĆ, M., PETROVIĆ, M.P., JOSIPOVIĆ, S., TOMIĆ, Z., CMILJANIĆ, R., TOMAŠEVIĆ, D., STRESOGLAVAC, S., MEMIŠI, N. (2002) Uticaj ranog odlučivanja jaradi blizanaca na njihov razvoj i proizvodnju mleka i mesa. Biotehnologija u stočarstvu 18(5-6): 81-85.

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ASSESSING PRACTICAL MARKERS FOR THEIR SUITABILITY IN ESTIMATING THE PAIN EXPERIENCED BY HORSES WITH LAMINITIS

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ABSTRACT

The assessment of pain experienced by horses is complex, often inaccurate, and varies widely among practitioners. During laminitis it is supposed that horses suffer severely from pain. It would be ideal if there were an accurate, reliable and sensitive method of assessing this pain as the condition progresses, and as treatment is applied, to improve the condition of the horse. This work considers various parameters and their suitability as markers to assess the pain experienced by horses undergoing treatment for laminitis. Fourteen horses were assessed during their treatment period. Heart rate, respiration rate and hoof temperature were all significantly correlated with the Obel grading score for lameness. Other parameters, including body temperature, digital pulse and behavioural attitude were not. The horses improved their lameness grade over the period of the trial. It is concluded that the use of the simple practical measures described may be usefully applied by owners and practitioners as markers to estimate the pain suffered by horses under their care.

Keywords: Laminitis, pain, horse, marker, obel score

INTRODUCTION

The purpose of this research project was to analyse the amount of the pain experienced by the horse when recovering from laminitis, pain which has been described as "unrelenting" (POLLITT, 2004), which would assist the veterinarian, and the owner of the horse, to make an informed decision regarding an indivudual horse's future. Medical assessment of pain experienced by humans is difficult enough, where the patient can respond and verbalise their experience. With animals this is much more complex, and with prey animals this is further complicated as they are likely to express expressions of pain as this might attract the attentions of a predator (ANIL ET AL., 2002). As reported by PRICE ET AL. (2002) there is a wide variation in the the scoring and management of pain in horses among veterinarians themselves A range of assessment tools are used. Previous work looking at before and after treatment with non-steroidal anti-inflammatory drugs has shown that hormone levels were largely unaffected by treatment (RIETMANN ET AL., 2004) and hormone levels remained unaffected after painful orhtopaedic surgery (RAEKALLIO *ET AL.*, 1997). And selected behavioural responses, inlcluding those of movement of a presumed painful leg, showed no differences (RAEKALLIO ET AL., 1997). Reliable assessments of pain remain to be determined even in the light of new technological tools such as diagnostic imaging (DYSON AND MARKS, 2003). There remains no "gold standard" method, technique or measurement that is reliable, repeatable and sensitive (VIÑUELA-FERNÁNDEZ ET AL., 2007).

The pathophysiology of laminitis in the horse remains unclear (BAILEY ET AL., 2003), and medication remains of limited help if the laminitis is severe. The causes, suffering and partial recovery are varied (MORGAN ET AL., 1999) and as a result horses continue to suffer, not only in one locality, but worldwide. Between 75-80% of laminitis cases identified do not recover (REED AND BAYLEY, 2004). It would be of great assistance to veterinarians and horse owners to have a better understanding of the pain experienced by equines with this condition, enabling early preventative treatment or early decisions regarding euthanasia of

the suffering individual; thereby reducing the overall suffering experienced both by individual horses, and the anxiety and distress of their owners.
The Obel scoring stystem (OBEL, 1948) is considered to be an accurate means of assessing the severity of laminitis (HURLEY ET AL., 2006), and it was decided to use this, subjective measure, as the reference measure for other parameters that might be more easily used by the practitioner and owner. Such measures included respiration rate, heart rate, body and hoof temperatures and others indicated in the method section of this paper.
The aim of this study was to analyse the amount of pain horses suffer when recovering from laminitis.

MATERIAL AND METHOD

There were 14 horses sampled in this study from a wide range of sources: warmbloods, Finnhorses, Icelandic horses and ponies. Icelandic horses were included as they are more inclined to obesity and therefore more likely to contract laminitis. Ages ranged from five to 26 years.
The study took place at Hyvinkään equine veterinary hospital in Hyvinkää, southern Finland, in the summer. The parameters below were taken on a daily basis during the period of their treatment, ranging from 1 day to 11 days. Treatment was with non-steroidal anti-inflammatory drugs (NSAID), rest, shoeing and polyurethane packing.
On arrival at the hospital an anamnesis was taken of each horse. The first inspection, as the subsequent daily observations, included measurements of attitude, heart rate, respiratory rate, temperature, digital pulse, temperature of the hoof. Lameness was evaluated with the Obel grading from one to four. This method has been described previously (GARNER ET AL., 1977). It is a scale from 0-4. Obel Grade I features frequent shifting of weight between the feet, no discernible lameness at the walk, and bilateral lameness at the trot. Obel Grade II horses do not resist having a foreleg lifted, nor are they reluctant to walk, but they do show lameness at the walk. Obel Grade III horses do resist having a foreleg lifted, and are reluctant to walk. Obel Grade IV horses will walk only if forced. The same assessor estimated lameness using this grade on each occasion throughout the study.
Attitude represented observation of their behaviour. This included: standing position of the horse, appetite; fresh hay was offered and its acceptance or otherwise was noted; position in the box, interest in its environment and signs of pain were recorded. Patients were observed if they were shifting their weight in the box and how much they were laying down.
Heart rate was measured manually, with a stethoscope, and respiration rate by observation by the first author. Temperature was taken rectally with a digital thermometer. The thermometer used was an ADC ADTEMP 422 Veterinary Digital Thermometer. Digital pulse was measured by palpation of the horse's digital arteries, which are on the inside and outside of each leg at the level of the fetlock and pastern. A normal horse should have a pulse that is very slight or difficult to feel.
The temperature of the hoof was assessed in comparison with the temperature of the adjacent hoof, by digital palpation by the first author, using a method described by RIETMANN ET AL. (2004).
Each of the horses staying overnight in the hospital were housed in individual boxes, with a thin layer of either wood shavings or peat as bedding. The choice of bedding was not related to factors related to laminitis, but simply of availability. Each horse was offered a diet solely of grass hay, and this was provided *ad libitum*. No additional feed was provided.
As the aim of this study was to identify relationships between lameness score and easily

measurable data, Pearson's correlations and regression analyses were calculated; data were analysed for correlations between parameters measured and Obel scoring for each horse. Obel grade was also correlated with days across all horses, using the Minitab statistical package, version 13.

RESULTS

As the numbers of observations for each horse were highly unbalanced means scores for each parameter were calculated for each horse across days. These parameters were then correlated with the Obel grade (*Table 1*).

Significant correlations were observed between Obel grade and: respiration rate (P = 0.008), heart rate (P = 0.005) and hoof temperature (P = 0.026). The most significant of these, the heart rate scores gave an R-squared value of 50.1% suggesting a possible, though not large, predictive value for this parameter.

Table 1. Correlations between Obel grade and other factors measured

Factor	Pearson's correlation coefficient	Probability
Respiration rate	0.672	0.008
Heart rate	0.708	0.005
Hoof temperature	0.590	0.026
Rotation	0.049	0.869
Digital pulse (forelimbs)	0.449	0.107
Digital pulse (hind limbs)	0.259	0.371
Hoof temperature	0.360	0.207
Day	-0.905	<0.001

Using multiple regression analysis, combining heart rate with hoof temperature gave a significant relationship (P = 0.007) with Obel grade, and an R-squared value of 59.4%. Further multiple regression analysis was not analysed, on the basis that the sample size of 14 horses would not support further statistical manipulation than the incorporation of two parameters into the model.

No correlations were found for either rotation, body temperature, digital pulse from either the front hind limbs, or behavioural attitudinal measures.

There was a significant day effect (P<0.001), with mean Obel grades negatively correlated (-0.905) with number of days over the study period.

Only one horse was euthanased at the completion of the data collection period, on the grounds of; the data from this horse was included in this analysis.

DISCUSSION

That three of the measured parameters, heart rate, respiration rate and hoof temperature were significantly correlated with the Obel grading of lameness gives hope that a simple measure, of practical and practicable use to owners and veterinary practitioners alike, may be realisable.

Although an increase in heart rate has been identified previously as a measure of pain experienced by animals (SANFORD ET AL., 1986), the finding that heart rate was

significantly correlated with Obel grade was not expected, following the findings of RAEKALLIO ET AL. (1997). However, these authors compared before and after (up to 72 hours after) surgery measures, and it may be that the current study, over a longer period, identified the response of increased heart rate to pain experienced over a longer period.
It may be that combining each of the significant parameters measured in this study: heart rate, hoof temperature and respiration rate, might give a more reliable index to assess pain than the use of one of these measures in isolation. There is evidence that this is the case for a combination of heart rate and hoof temperature.
Behavioural assessments did not show significant correlations with lameness, which is a finding that is in line with previous observations by RAEKALLIO ET AL. (1997) and proposals by WOOLF AND DECOSTED (1999) that behaviour is little value in assessing pain. Therefore their use, or at least their sole use, cannot be recommended as reliable indicators of pain experienced by the horse in cases of laminitis. Of the other parameters tested and found to show no significant correlation with Obel grade: temperature, digital pulse and rotation, the last is confirmation of the findings by HUNT (1993) who also found no effect on the degree of rotation.
It might be argued that the Obel grade itself could be used to assess levels of pain, as it is already considered a reliable estimate of lameness (HURLEY ET AL., 2006). However, this is not a sensitive scoring system, using a system of four grading levels, might not reliably assess pain, and involves the horse in moving and trotting to assess the grade, activities that might well be a source of additional pain to the animal.
The finding that Obel grade was significantly negatively correlated with day in treatment is a reassuring one, at least to this practice. Lameness among the horses declined during their treatment at the equine hospital.
While not claiming to have found the "gold standard" for accurate and reliable pain assessments in the horse, identified as desirable and missing by VIÑUELA-FERNÁNDEZ ET AL. (2007), this study provides hope that simple, applicable parameters can possibly be used by horse owners and practitioners as a guide to the pain experienced by horses suffering from laminitis. Furthermore, the use of such markers may allow the identification of a problem before the onset of clinical laminitis.

Animal Welfare Implications

If it can be shown that these findings are repeatable, owners of horses with laminitis, and veterinarians may have practical and applicable markers for pain experienced by the horses under their care. This has applications in the prompt consultation of veterinarians by owners, and efforts to provide analgesia. Recovery from this affliction could also be observed rapidly by owners, and conversely continuing evidence for high levels of pain in individual horses identified, allowing early judgement regarding the advisability of euthanasia which would reduce the length of suffering endured by the horse.

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REFERENCES

ANIL, S.A., ANIL, L., DEEN, J. (2002): Challenges of pain assessment in domestic animals. Journal of the American Veterinary Association 220(3): 313-319.

BAILEY, S.R., MARR, C.M., ELLIOTT, J. (1993): Current research and theories on the pathogenesis of acute laminitis in the horse. The Veterinary Journal 167(2): 129-142.

DYSON S. AND MARKS D. (2003): Foot Pain and the Elusive Diagnosis. The Veterinary Clinics of North America Equine Practice 19(2): 531-565.

GARNER, H.E., HUTCHESON, D.P, COFFMAN, J.R., HAHN, A.W., SALEM, C. (1977): Lactic Acidosis: a Factor Associated with Equine Laminitis. Journal of Animal Science 45: 1037-1041.

HUNT, R.J. (1993). A Retrospective Evaluation of Laminitis in Horses. Equine Veterinary Journal 25(1): 61-64.

HURLEY, D.J., PARKS, R.J., REBER, A.J., DONOVAN, D.C., OKINAGA, T., VANDENPLAS, M.L., PERONI, J.F., MOORE, J.N. (2006): Dynamic Changes in Circulating Leukocytes During the Induction of Equine Laminitis with Black Walnut Extract. Veterinary immunology and immunopathology 110(3-4): 195-206.

MORGAN, S.J., GROSENBAUGH, D.A., HOOD, D.M. (1999): The Pathophysiology of Chronic Laminitis. Pain and Anatomic Pathology. The Veterinary Clinics of North America - Equine Practice 15: 395-417.

OBEL, N. (1948): Studies on the histopathology of acute laminitis. Thesis. Almquist and Wiksells Boktryckteri, AK, Uppsala, Sweden.

POLLITT, C. (2004): Equine Laminitis. Clinical Techniques in Equine Practice 3(1): 34-44.

PRICE, J., MARQUES, J.M., WELSH, E.M., WARAN, N.K. (2002): Pilot Epidemiological Study of Attitudes Towards Pain in Horses. The Veterinary Record 151(9): 570-575.

RAEKALLIO, M., TAYLOR, P.M., BLOOMFIELD, M. (1997): A comparison of Methods for Evaluation of Pain and Distress After Orthopaedic Surgery in Horses. Journal of Veterinary Anaesthesia 24(2): 17-20.

REED, S.M., BAYLEY, W.M., SELLON, D.C. (2004): Equine Internal Medicine. Saunders. 1659 p.

RIETMANN, T.R., STAUFFACHER, M., BERNOSCONI, P., AUER, J.A., WEISHAUPT, M.A. (2004): The Association Between Heart Rate, Heart Rate Variability, Endocrine and Behavioural Pain Measures in Horses Suffering from Laminitis. Journal of Veterinary Medicine. Series A. 51: 218-225.

SANFORD, J., EWBANK, R., MOLONY, V., TAVERNOR, W.D., UVAROV, O. (1986). Guidelines for the recognition and assessment of pain in animals. Veterinary Record 118: 334-338.

VIÑUELA-FERNÁNDEZ, I., JONES, E., WELSH, E.M., FLEETWOOD-WALKER, S.M. (2007): Pain Mechanisms and Their Implication for the Management of Pain in Farm and Companion Animals. The Veterinary Journal 174(2): 227-239.

WOOLF, C.J., DECOSTED, I. (1999): Implications of Recent Advances in the Understanding of Pain pathophysiology for the Assessment of Pain in Patients. Pain suppl. Vol.6:S141.

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RELATIONSHIP BETWEEN THE BODY CONDITION AND THE APPEARANCE PARAMETERS OF HOLSTEIN-FRIESIAN COWS

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ABSTRACT

The body condition has been part of the livestock judgment in Hungary since 2007. This date can be called relatively late, because in Ireland and Britain body condition scoring has been part of the conformation judging system of Holstein-Friesian cows since 1996. In our study we analysed the mean of linear characteristics within lactations, and compared the results to the ideal values of each characteristic. We also analysed the correlation between body condition and linear type traits. The results of the relationship between the body condition and the linear descriptive characteristics in case of body measurement are weak (r=0.09), or medium (r=0.29) and except for the angularity (between r=-0.39 and r=-0.50) they are positive. When analysing the main functional areas, we also compared the difference among the scores of the lactations. We investigated the relationship between the body condition and the main functional types. Overall we founded that the increase in the number of lactations as well as the improving body condition had a positive effect on the body score. When investigating the relationship between the body condition and the dairy strength a negative correlation was found between these two attributes.

Keywords: body condition scoring system, milk production, energy reserve, nutritional management, reproduction management

INTRODUCTION

The body condition has been part of the livestock judgment in Hungary since 2007. This date can be called relatively late, because in Ireland and Britain body condition scoring has been part of the conformation judging system of Holstein-Friesian cows since 1996 (PRYCE ET AL., 2000). It was in 2004 that the breeders began to be interested in BCS in Hungary, because then the Veepro Company (from Holland) and the Holstein-Friesian Breeders Association (from Hungary) organized a practical training about BCS (BOGNÁR (2004). Then, however the BCS method being part of type classification system was not presented; the Dutch expert showed the practical method of BCS (on a scale of 1-5). In the 26th European Holstein and Red Holstein Conference JONG (2005) demonstrated the benefits of using the BCS system; the method was illustrated on a nine point scale. The body condition scoring system was introduced in eight countries that year.

In Hungary the body condition scoring became part of the classification system in 2007, in accordance with recommendations by ICAR. The problems of dairy herd (reproduction disorders, early disposal) emphasized the importance of relationships between linear type traits and some quality parameters. BERTA (2010) examined the relationship between longevity and linear type traits. Based on their results it seems that the cows that were culled later have a taller rump, a stronger and deeper body, taller real udder height and better udder cleft with a less deep udder than those of the earlier culled animals. According to GÁSPÁRDY ET AL. (1995) the useful lifetime is too short to be influenced by the appearance characteristics (based on the constitution and body solidity). The early culling of cows from the production can be caused by other factors. ROYAL ET AL. (2002) calculated a -0.84 genetic correlation between BCS (at classification) and calving interval. DECHOW ET AL. (2003) analysed a −0.73 genetic correlation between BCS and dairy form,

whereas the genetic correlation between BCS and strength was 0.72. The genetic correlation between body condition score and the final score was rather low (0.08). The correlation between sharpness and body condition was -0.40 given by PRYCE ET AL. (2000). BASTIAN ET AL. (2007) also reported a negative relationship between sharpness and body condition (r = -0.35 r = -0.73.) The contrast between the two parameters can be the result of the improved condition masked the sharpness. KADARMIDEEN AND WEGMANN (2003) searched for significant association between the linear type traits, the main judgement characteristics and the body condition. They analysed the correlation between the body condition and chest width (r=0.17) and between BCS and body capacity (0.19) Body condition score had a negative correlation with dairy strength (-0.35) and udder quality (-0.42). Estimates of correlations between the BCS and final class (0.13) were not significant.

MATERIAL AND METHOD

We analysed the mean of linear characteristics within lactations, and compared the results to the ideal values of each characteristic. We also analysed the correlation between body condition and linear type traits.

The results of the groups were compared to the results within the number of lactations. The correlation examinations were also analysed within the lactation groups. The data were analyzed by the method of variance. The relationship between variables was examined with correlation analysis tests (Pearson's correlation coefficient).

The relationship between the values of different lactation (first, second and third lactations) were investigated by Spearman's rank correlation coefficients.

Table 1. The linear parameters in different lactation (1- 3.)

	Lactation number			Ideal values	r_{rang}	
	1 n=861	2 n=964	3 n=634		1-2	1-3
Stature	6.05^{a}	6.58^{b}	**6.94^{c}**	7-9	0.74**	0.84**
Chest width	5.47^{a}	5.80^{b}	6.15^{c}	9	0.62**	0.81**
Body depth	5.65^{a}	6.14^{b}	6.54^{c}	9	0.59**	0.72**
Angularity	5.80^{a}	5.94^{b}	5.99^{b}	9	0.44**	0.29
Body condition score	4.86^{a}	4.63^{b}	4.53^{c}	5	0.29**	0.50*
Rump angle	5.38^{a}	**5.09^{b}**	**4.93^{c}**	5	0.69**	0.64**
Rump width	5.12^{a}	5.47^{b}	5.81^{c}	8	0.70**	0.61**
Rear legs set	5.78^{a}	5.94^{b}	6.21^{c}	5	0.64**	0.58**
Rear legs rear view	5.46^{a}	5.41^{ab}	5.30^{b}	9	0.65**	0.70**
Locomotion	5.64^{a}	5.62^{a}	5.39^{b}	9	0.71**	0.72**

** P<1%,* P<5%;

The ideal values developed based on the recommendations by the Holstein-Friesian Breeders Association

RESULTS

When examining the appearance parameters (*Table 1*) we tried to find out what effect the body condition has on the descriptive linear characteristics and the main judgement characteristics.

In the results of the descriptive linear characteristics we found differences between the ones with different lactation numbers. The average values of the characteristics are seldom in the ideal interval. The body condition is the most favourable in the first lactation, later it decreases. The results of the rank correlation analysis in the first and second as well as the first and third lactations confirmed a medium or tight correlation. Considering the BCS there is a loose correlation (r_r=0.29) between the first and second lactation, while there is a medium (r_r=0.50) correlation between the first and the third lactation. These results suggest that we cannot predict the further lactation results on the basis of the estimated body condition in the first lactation.The results (*Table 2*) of the relationship between the body condition and the linear descriptive characteristics in case of body measurement are weak (r=0.09), or medium (r=0.29) and except for the angularity (between r=-0.39 and r=-0.50) they are positive. PRYCE ET AL. (2000) also found a negative relationship between body condition and sharpness.

Table 2. Relationship between the body condition and the linear descriptive characteristics

	Lactation number		
	1 n=861	2 n=964	3 n=634
Stature	0.09*	-0.03	-0.03
Chest width	0.29**	0.27**	0.22**
Body depth	0.16**	0.07*	-0.02
Angularity	-0.39**	-0.47**	-0.50**
Rump angle	0.07*	0.10**	0.01
Rump width	0.19**	0.13**	0.05
Rear legs set	-0.27**	-0.17**	-0.29**
Rear legs rear view	0.30**	0.21**	0.28**
Locomotion	0.22**	0.09**	0.11**

** P<1%,* P<5%

The relationship between stature and body condition is not confirmed, the strength shows weak correlation, the value of the correlation coefficient is the largest in the first lactation. KADARMIDEEN AND WEGMANN (2003) also showed a loose correlation (r = 0.17), however DECHOW ET AL. (2003) obtained a tight relationship (r=0.73) between the two parameters.

CONCLUSIONS

The results of our study show that the body condition of the cows can be associated with their other linear descriptive characteristics as well. We found a medium correlation between the first and the third lactation of body condition. The estimated body condition

scores at type-classification can be utilised as valuable information sources because the dairy type can be detected with them. Based on this research the integration of the regular body condition scoring into the technology is especially important. The results of livestock judgement should be evaluated periodically (after the milk recording, when the animals are selected into feeding groups).

REFERENCES

BASTIN, C. LALOUX, L. GILLON, A. BERTOZZI, C. VANDERICK, S. GENGLER, N. (2007): First results of body condition score modeling for Walloon Holstein cows. http://www-interbull.slu.se /bulletins/bulletin37 /Bastin.pdf (2011.01.11.)

BERTA, A. (2010): A hasznos élettartam növelésének tenyésztési lehetőségei tejelő szarvasmarha állományokban. PhD értekezés. Debreceni Egyetem Állattenyésztési Tudományok Doktori Iskola. 142 p.

BOGNÁR, L. (2004): Három borda = 3,5 kondició pont, lehet, hogy tényleg ilyen egyszerű volna! Holstein Magazin 12(6): 15-17.

DECHOW, C.D. ROGERS, G.W. KLEI, L. LAWLOR, T.J. (2003): Heritabilities and correlations among body condition score, dairy form and selected linear type traits. J. Dairy Sci. 86(6): 2236-2242.

GÁSPÁRDY, A., BOZÓ, S., SZŰCS, E., THAN, A.T. (1995): A küllemi tulajdonságok összefüggése a hasznos élettartammal eltérő marmagasságú holstein-fríz tehenekben. Állattenyésztés és takarmányozás 44(3): 227-241.

JONG, G. DE (2005): Body condition score, an extra service from hedbook organisation for farmers and cattle improvement The 26th European Holstein and Red Holstein Conference, Prague. pp. 1-6.

KADARMIDEEN, H.N., WEGMANN, S. (2003): Genetic parameters for body condition score and its relationship with type and production traits in swiss holsteins. J. Dairy Sci. 86(11): 3685-3693.

PRYCE, J.E., COFFEY, M.P., BROTHERSTONE, S. (2000): The genetic relationship between calving interval, body condition score and linear type and management traits in registered holsteins. J. Dairy Sci. 83(11): 2664-2671.

ROYAL, M.D., PRYCE, J.E., WOOLLIAMS, J.A., FLINT, A.P.F. (2002): The genetic relationship between commencement of luteal activity and calving interval, body condition score, production, and linear type traits in holstein-friesian dairy cattle. J. Dairy Sci. 85(11): 3071-3080.

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RESULTS OF ANALYSIS OF IRRIGATION WATER LOCATED MAINLY IN COUNTY BACS-KISKUN

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ABSTRACT

Ground water samples, collected mainly in Kecskemét and its outskirts, were analysed in the laboratory of Faculty of Horticulture (Kecskemét College). Depending on the depth three categories of the sprinkling water samples were formed: 10-30, 31-70 and 71-275 m, respectively. Chemical analysis of 103 water samples showed the decrease in the salt content with deepness (conductivity (EC) decreased from 1116 to 682 $\mu S.cm^{-1}$ in the deepest groundwater samples). It was the result of the decrease primarily in sodium, hydro-carbonate and chloride contents in the samples. Acidity and alkalinity of the samples didn't change with deepness considerably in our samples. The levels of nitrogenous and phosphorous ions were low in almost all water samples. Ferrous, manganese and arsenic content was the highest in the middle deep water region (31-70 m depth). These results may reveal problems in the application of these water sources in agriculture, mainly in growing and irrigation because of high salt concentration, principally thanks to hydro carbonate and metallic ions. Acidic pre-treatment of these irrigation waters seems to be crucial.

Keywords: sprinkling water, chemical analysis, groundwater, salt content

INTRODUCTION

Throughout the world, irrigation (water for agriculture or growing crops) is probably the most important use of water (almost 60 percent of all the world's freshwater withdrawals go towards irrigation uses). Irrigation water of crop fields may originate from rivers, lakes, reservoirs, and wells. Similarly to other Southern European countries, irrigation is essential for agricultural production in the south plane region of Hungary. The region of our experiments, mainly county Bács-Kiskun, is one of the most productive areas of the country. Sandy soils located here have low moisture-holding capacities, so irrigation significantly increases crop yields and quality. Water sources are often used for liquid fertilizer application, as well.

In our study irrigation water samples from ground origin were analysed. Groundwater, under most conditions, is safer and more reliable for use than surface water. However, groundwater can be contaminated through natural origin and by chemicals that are easily soluble and penetrate the soil layers. These pollutants can reach aquifer system and in the end private wells. The water quality used for irrigation is essential for the yield and quantity of crops, maintenance of soil productivity, and protection of the environment. For example, the physical and mechanical properties of the soil, soil structure and permeability, are very sensitive to the type of ions present in irrigation waters (BAUDER AND BROCK, 2001; PEREIRA ET AL., 2002).

The excess of salt content is one of the major concerns with water used for irrigation. A high salt concentration present in the water and soil will negatively affect the crop yields, degrade the land and pollute groundwater. High carbonate and hydro-carbonate ions (CO_3^{2-}, HCO_3^-) increase SAR index.

Natural nitrate levels in groundwater are generally very low (typically less than 10 mg/l NO_3), and it is the case with phosphate forms, as well. Metallic and semi-metallic ions,

such as iron, manganese and arsenic may be present in natural rural groundwater supplies, causing a common problem: its concentration may be many times larger than the allowed level. Iron may occur naturally in the aquifer but the level in groundwater can be increased by dissolution of some ferrous mechanic pumping components. Inorganic arsenic can occur in the environment in several forms in natural waters, and thus in irrigation water, it is mostly found in trivalent arsenite (As(III) form (GRAFE ET AL., 2002).

MATERIAL AND METHOD

Groundwater samples were collected in two times rinsed plastic containers after running out water for some minutes, bags or bottles were totally filled, reclosed and refrigerated, and transported to laboratory analysis as soon as possible (within 24 hours of sampling). Correct sampling, storage and transportation are critical to the accuracy of analysis. Measurements were carried out in Soil and Plant Analysing Testing Laboratory of Faculty of Horticulture, Kecskemét College.

Avoiding precipitation, 100 ml water samples were acidified slightly with HNO_3 for (semi)metallic ion measurements. Instrumental analysis were carried out as soon as possible, whereas pH and electrical conductivity (EC) measurement were made immediately. EC and pH of tempered samples were measured using laboratory EC and pH-meter, Ca^{2+}, Mg^{2+}, Na^{+}, K^{+}, Fe, Mn, As and PO_4^{3-} content were analysed by ICP-OES spectrometry (Horiba JY). Hydro-carbonate and chloride (HCO_3^{-} and Cl^{-} ions were measured volumetrically. Nitrate and ammonium in samples were determined by flow FIA analysis and spectrometric detection (FiaStar Analyzer). Standard analytic methods were used in the case of all parameters.

103 groundwater samples were collected from private founts in the south-east region of Hungary, primarily county Bács-Kiskun. Samples were distributed into three categories with deepness of the source of water: 5-30 m, 31-70 m and 71-275 m, respectively. Analytic results were compared and statistically valuated.

RESULTS

As shown in *Table 1*, acidity of water samples didn't change with deepness considerably. The spread of acidity/alkalinity decreased in samples. Decreasing tendency of EC in the deepest water source region, reflecting dissolved saline content, was also shown *(Table 1.)*.

Table 1. pH and electrical conductivity of water samples according to deepness in the three categories

	5-30 m		31-70 m		71-275 m		threshold
	average	SD	average	SD	average	SD	limit
pH	7.25	0.44	7.32	0.39	7.30	0.25	6.5-7.8
EC, µS/cm	1116	887	978	847	682	267	1000

Major ions present in groundwater samples are shown in *Figure 1.* Main anion in samples was bicarbonate, which is a natural characteristic ion in this pH range in our region. The level of the contaminant chloride ion decreased considerably with deepness.

According to major cations, the average of ion concentrations didn't succeed the threshold limit in all deepness. Potassium levels were extremely low (falling from 11.4 to 2.49 mg/l).

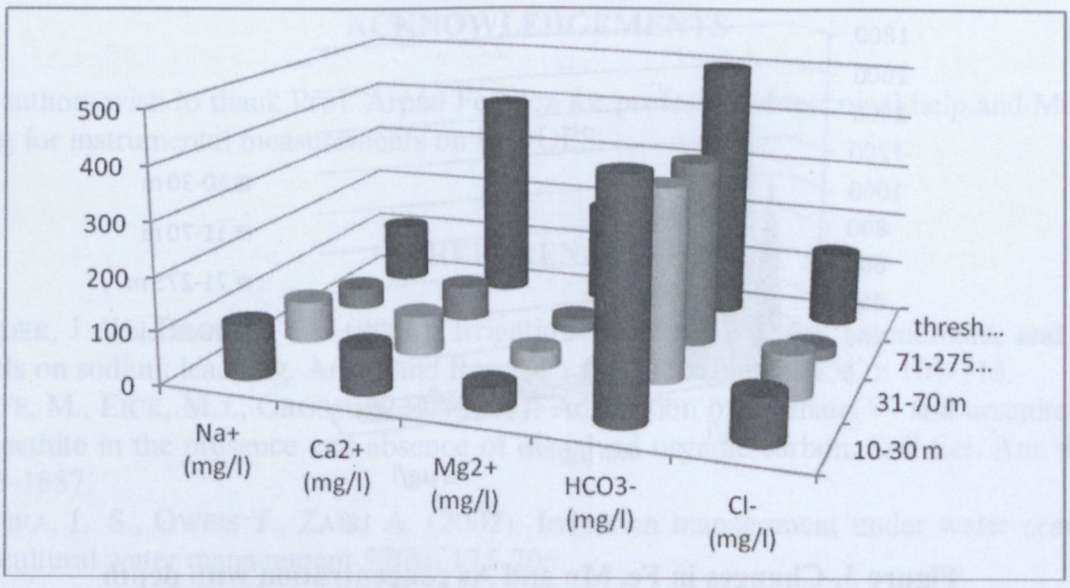

Figure 1. Sodium, calcium, magnesium, bicarbonate and chloride concentration in groundwater samples

Levels of contaminant nitrogenous and phosphorous forms were also determined, concentration of NH_4^+, NO_3^- and PO_4^{3-} were the lowest in irrigation water samples came from the deepest layer region (*Figure 2).*

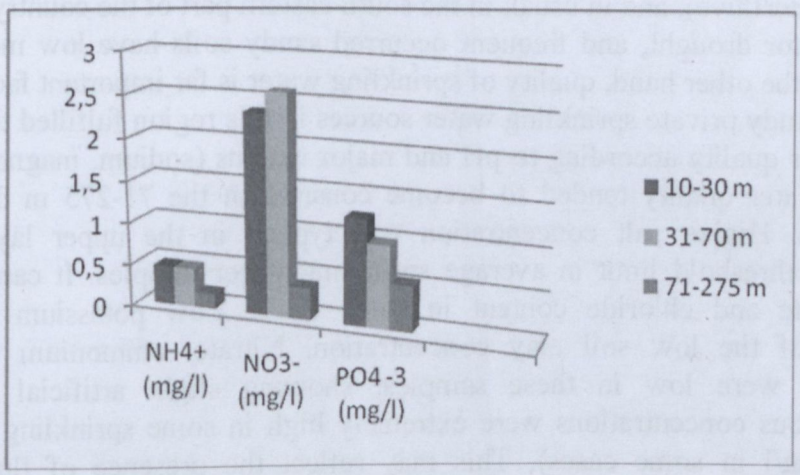

Figure 2. Ammonium, nitrate and phosphate concentration in water samples

Concentration of ferrous, manganese and arsenic are shown in *Figure 3*. The level of Fe transcended the threshold limit in the upper layer waters. All examined (semi)metallic ion concentrations were the highest in the middle deep region.

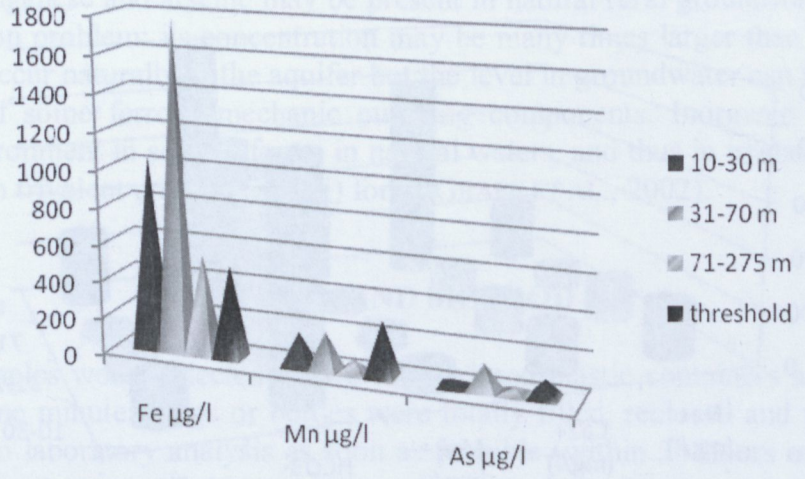

Figure 3. Changes in Fe, Mn and As concentration with depth

CONCLUSIONS

Irrigation in agriculture plays a major role in food production and food security. Future agricultural development strategies may depend on the possibility to maintain, expand and improve irrigated agricultural lands. This is the case specifically in county Bács-Kiskun (Duna-Tisza interfluve), and in usual, in the south-eastern part of the country. This territory is susceptible for drought, and frequent occurred sandy soils have low moisture-holding capacities. On the other hand, quality of sprinkling water is far important factor. According to our recent study private sprinkling water sources in this region fulfilled the standards of irrigation water quality according to pH and major cations (sodium, magnesium, calcium, potassium). Water quality tended to become constant in the 71-275 m deep sprinkling water samples. Higher salt concentration was typical in the upper layer (10-30 m), exceeding the threshold limit in average sprinkling water samples. It came from higher hydro-carbonate and chloride content in some cases. Low potassium content is the consequence of the low soil clay concentration. Nitrate, ammonium and phosphate concentrations were low in these samples, showing slight artificial contamination. However, ferrous concentrations were extremely high in some sprinkling water samples (3000-4000 mg/l in some cases). This may reflect the presence of fluvial sediments containing high ferrous content, primarily in the middle deep layer samples. Arsenic can be absorbed on the surfaces of Fe-O-OH containing sediments (VARSÁNYI AND KOVÁCS 2006, RAYMAHASHAY AND KHARE, 2003). This is in accordance with our results showing higher As concentration in the 31-70 m depth. However, high ferrous concentration may be resulted from sampling faults. Pre-treatment of these sprinkling waters with nitric acid or phosphoric acid is far suggested avoiding precipitation of ferrous residue in mechanic irrigation components (primarily at trickle irrigation). Acidification is recommended to remove excess bicarbonate as well. Taking account these results may help us in economical use of water resources for agriculture and avoiding threat to the environment.

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REFERENCES

BAUDER, J. W., BROCK T. A. (2001): Irrigation water quality, soil amendment, and crop effects on sodium leaching. Arid Land Research and Management 15(2): 101-113.

GRAFE, M., EICK, M.J., GROSSL, P.R. (2001): Adsorption of arsenate(V) and arsenite (III) on goethite in the presence and absence of dissolved organic carbon. Soil Sci. Am. J. 65: 1680–1687.

PEREIRA, L. S., OWEIS T., ZAIRI A. (2002): Irrigation management under water scarcity. Agricultural water management 57(3): 175-206.

RAYMAHASHAY, B.C., KHARE, A.S. (2003): The arsenic cycle in Late Quaternary fluvial sediments: Mineralogical considerations. Current Science 84: 1102–1104.

VARSÁNYI, I., KOVÁCS L. O. (2006): Arsenic, iron and organic matter in sediments and groundwater in the Pannonian Basin, Hungary. Applied Geochemistry 21: 949–963.

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EFFECTS OF SOIL TYPES AND NITROGEN FERTILIZER DOSES ON SOME CHEMICAL CHARACTERISTICS OF TOMATO, SWEET CORN AND PEPPER

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ABSTRACT
Our research project was aimed at the description of the nitrogen and carbon flows in soils and vegetable cultures. As a part of this project we made our experiments in the nursery garden of our Institute (Kecskemét College, Faculty of Horticulture), using irrigated and fertilized lysimeters. Three different soil types (sandy, alluvial and chernozem soils) were studied. At constant phosphorus and potassium fertilizer doses (P_{60}:K_{120}), four different nitrogen doses (0, 60, 120 and 180 kg.ha-1 N) were used. Total N levels and other parameters were determined in two harvesting times in tomato (type K-549) and sweet corn (variety 'Spirit') as well. According to other parameters of the tested vegetables, organic acid contents increased in tomato berry on sandy and alluvial soils at higher nitrogen fertilizer doses. Sugar content was higher in tomato grown on alluvial and chernozem soils. Nitrogen doses decreased sugar contents in chernozem in the case of both vegetables. The increase in vitamin C levels of tomato in sandy soil was slight due to higher nitrogen doses. The highest sugar content in sweet corn was measured due to farmyard manure treatment. According to green and red pepper test plants, the effect of nitrogen fertilizer (ammonium-nitrate) and barnyard manure on crop mass seemed to be highly positive in our experiments.

Keywords: nitrogen fertilizer, soil types, lysimeter, tomato, sweet corn

INTRODUCTION

The central object of our research project was to examine sustainable cropping through supplying nutrients in accordance with nutritive uptake and irrigation, and studying organic material uptake dynamics. For the examination of vegetable cultures a model imitating organic/inorganic carbon and nitrogen flow was used, and during our experiments microbiologic activity and organic material metabolism of soils were studied continuously in different textures and organic contents. We showed that high nitrogen addition treatments (120 and 180 kg.ha^{-1} N) accelerated cellulose decay in clay loam soil (SZILI-KOVÁCS ET AL., 2009). Intensive vegetable growing may encumber mainly the soil and natural and ground water among the environmental factors as a result of intensive irrigation and inadequate organic and inorganic nutrient use (NÉMETH, 2006; KÁDÁR, 2007).
In our recent study we focus on the influence of different nitrogen doses on crop mass and the chemical composition of some plant organs of tomato and sweet corn, as indicator plants.

MATERIAL AND METHOD

Our experiment series were carried out in the nursery garden of Faculty of Horticulture, Kecskemet College, as a part of the study project supported by the Hungarian Scientific Research Fund. The experiments were carried out in lysimeters with 0.6 m height and diameter, a drip irrigation system was used to ensure sufficient soil water supply to the

tomato test plant, type K-549. The two variable treatments were as follow: three soil types (sandy, alluvial and chernozem) and four nitrogen fertilizer doses: 1. Control, 2. N_{60}:P_{60}:K_{120}, 3. N_{120}:P_{60}:K_{120}, and 4. N_{180}:P_{60}:K_{120} kg ha $^{-1}$ N, P_2O_5 and K_2O active agent, in six repetitions. The most characteristic physical and chemical parameters of the examined soil types were described in our other paper (VÉGH ET AL., 2007). Basic fertilizer was applied before planting as a slow release fertilizer Cropcare (10:10:20) in 600 kg ha^{-1}. Nitrogen was applied three and six weeks later as 34% NH_4NO_3. In the case of sweet corn, the applied N doses were the same, with the exception in the treatment 3: N_{120}:P_{60}:K_{120} was completed with barnyard manure in 150 t ha^{-1} dose incorporated to soil before sowing. In the case of green and red pepper test plants N-treatments were the follows: 1. Control, 2. N_{60}:P_{60}:K_{120}, 3. N_{120}:P_{60}:$K_{120+165}$ t/ha barnyard manure, és 4. N_{180}:P_{60}:K_{120} kg/ha N, P_2O_5 és K_2O, in six replicates.

Laboratory tests were made in the Soil and Plant Testing Laboratory of our Faculty of Horticulture (Kecskemét College). Total nitrogen, phosphorus, potassium contents in tomato leaves and fruits, acid, sugar and vitamin C levels in tomato fruit were analyzed in two harvest times (1st examination: 15th August and 2nd examination: 28th August). We determined total nitrogen levels in young (apical) and old (basal) leaves as well. Next year sweet corn, variety 'Spirit' (SG), a short vegetation period species, was used in our experiments. Leaf samples of sweet corn were collected three times: first in 5-6 leaves stage, second at the beginning of silking and third at harvest. Total nitrogen levels were determined by Kjeldahl method (FOSS Kjeltec 2300), total phosphorus and potassium contents were analyzed by ICP-OES spectrometer (HORIBA Jobin Yvon) after microwave digestion. Further parameters including total free acid content, total sugar (Schoorl method), and vitamin C were determined by volumetric analysis. Red pepper powder quality was characterized by ASTA (American Spice Trade Association) level.

RESULTS

At the first harvest time, the lowest total nitrogen content was shown in tomato plant leaves grown in sandy soil (1.69%), while this was higher in chernozem and alluvial soil, by 18 and 50%, respectively. At the end of peduncle (younger, apical leaves) the total N content was 3.65% and at the basal part of peduncle (basal, older leaves) this value was 2.42%.

The results of the second harvest time analysis showed total N levels of 2.41% in young leaves and 2.03% in old leaves grown in sandy soil, on the average. Increasing nitrogen doses increased N content both in young and old leaves in sandy soil, which must have been the result of the poor nitrogen supply of this soil type.

According to the tomato fruit analysis, increasing N doses increased total N content by 6-32% in both harvest times as compared to control. On the contrary, total phosphorus levels decreased continuously by increasing N fertilizer doses in sandy soil (from 0.74 to 0.34% in young leaves and from 0.70 to 0.41% in the old ones). This effect in the fruit was negligible.

According to our crop mass investigation, there was a slight increase in the total crop mass of tomato berry from sandy soil to alluvial and chernozem soils (*Figure 1*). This may be the result of the naturally existing difference in the nutrient supplier capacity of these soils. N_{120} and N_{180} N doses increased crop mass statistically significantly as compared to the control, in all soil types (LSD 5%), independently of the soil types.

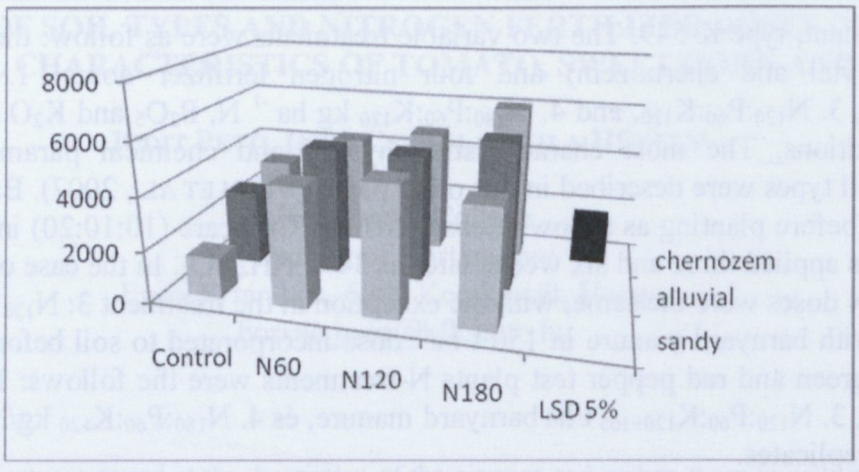

Figure 1. Changes in total crop mass of tomato (g/lysimeter) after different N fertilizer doses

Our results, concerning the mass of tomato berries, show the highest average crop mass of berry in control parcels, coupled with the lowest total crop mass. Significantly negative correlation between total crop mass and average mass of berries was also shown. It is in accordance with the known observations: rich crop couples with smaller crop size.

According to acid content of tomato fruit it was 0.38% in sandy soil, 0.43% in alluvial and 0.53% in chernozem soil, on the average. At to the 1st harvest time higher N doses increased the acid level in sandy and alluvial soils, while the highest N_{180} kg ha^{-1} dose did not result in increasing acid levels in chernozem because of the balanced nutritive supply in this type. At the second examination time a tendency to increase in acid content was shown in sandy soil, but it equalized in alluvial and chernozem soils, due to increasing N fertilizer doses.

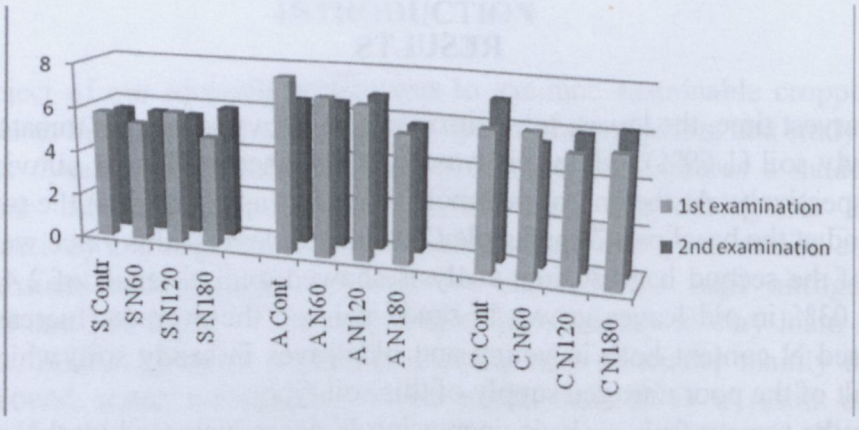

Figure 2. Changes in sugar/acid ratio of tomato fruit grown in sandy (S), alluvial (A) and chernozem (C) soil after different N fertilizer doses

Mean sugar content in tomato berry increased to 2.84 in alluvial and to 3.14 in chernozem soil as compared to 2.09% level measured in fruit grown in sandy soil (1st examination). Sugar contents were almost the same at the second examination, irrespectively of soil types. The sugar level enhancing effect of higher N fertilizer doses was shown only in sandy soil.

Vitamin C content in tomato fruit increased slightly after nitrogen treatment in sandy soil. In alluvial soil this increase was less while a remarkable decline was shown in chernozem at 60 and 120 kg ha^{-1} nitrogen doses. Vitamin C content decreased in all examined soil types at the 2nd examination time.

Changes in sugar/acid ratio in tomato berry are shown in *Figure 2*. The illustrated changes are in agreement with the above mentioned changes in acid and sugar levels of tomato berry during the growing season. The highest sugar/acid ratios were reached on alluvial soil at the first examination, which differed significantly from the other two soil types (SD 5%). Increase in N fertilizer doses did not cause significant changes.

According to sweet corn test plant analysis total N content in leaves were the highest at the beginning of the vegetation period, reaching about 1% till harvesting. At harvest time N levels in sweet corn leaves and seeds were independent of N doses and soil types. The highest sugar content in sweet corn was measured due to manure treatment, while low and high N doses tended to decrease it (*Table 1*).

Table 1. Total sugar content (g/kg) in sweet corn seeds after different N treatments

Treatment	Sand	Chernozem
Control	6.6	3.8
N60	4.4	2.6
N120 + manure	11.6	7.9
N180	4.4	6.3

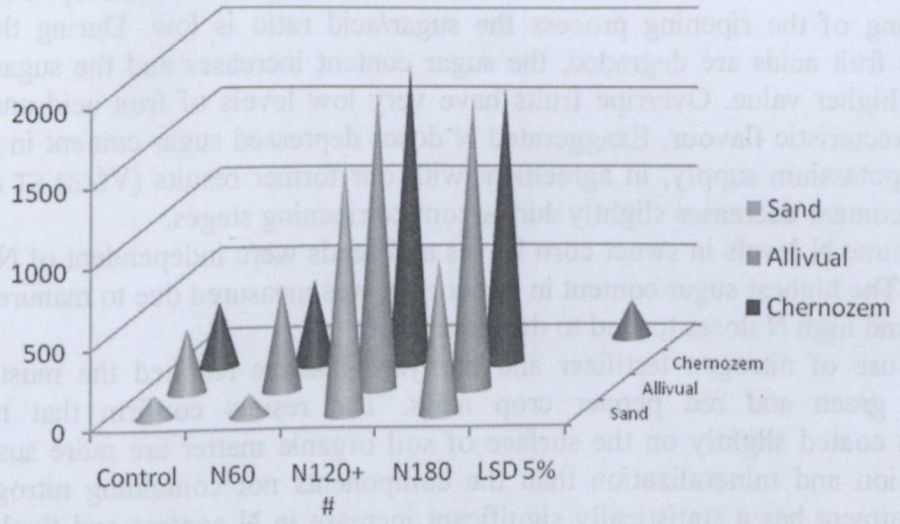

Figure 3. Changes in total crop mass of red pepper (g/lysimeter) after different N fertilizer doses.

The results of red pepper (paprika) crop mass are shown in *Figure 3*. The highest crop mass was reached by use of barnyard manure in alluvial soil. Red pepper powder quality was the best in the case of growing on alluvial soil (131 vs. 124 and 114 ASTA color value in alluvial compared to chernozem and sandy soil).

The examinations showed similar tendencies in the case of green pepper. Best total crop mass was reached after treatment with combination of NH_4NO_3 and manure. Final crop mass was 1869 and 1867 g/lysimeter compared to 1592 g/lysimeter in alluvial, chernozem and sandy soil.

CONCLUSIONS

In our four-year study period we investigated the effect of different soil types and nitrogen fertilizer doses, on crop mass and some chemical components of fruit and vegetative parts, in four test plants. Chernozem, alluvial and sandy soils are the three most common soil types in Hungary, significantly differing in structure, water reserving and nutrient supplying capacity etc.

N_{120} and N_{180} N doses increased crop mass statistically significantly in tomato test plants as compared to the control, in all soil types (SD5%), independently of the soil types. N_{60} and N_{120} kg ha^{-1} N fertilizer doses seemed to compensate for the differing nutrient supplier capacity of the examined soils. Nevertheless, increasing N dose to N_{180} kg ha^{-1} level resulted in increasing total crop mass only in alluvial and chernozem soils. This phenomenon may attract the attention to the better water dynamics and textural properties of these soils, compared to sandy soil. The crop yield enhancing effect of N fertilizer in sweet corn was also shown. Leaf examination results in tomato confirmed nitrogen translocation process. Leaf analysis in sweet corn showed decrease in N content in leaves from the beginning of the vegetation period till harvesting. This phenomenon calls attention to the importance of the time and place of leaf sampling, the age of plant, the position of leaf and nutritive capacity of the soil, so as to get correct diagnostic data.

Flavour characteristics of tomato fruit depend largely on the sugar and acid content of the berry. It is the sugar/acid ratio which contributes towards giving many fruit their characteristic flavour and so it is an indicator of commercial and organoleptic ripeness. At the beginning of the ripening process the sugar/acid ratio is low. During the ripening process the fruit acids are degraded, the sugar content increases and the sugar/acid ratio achieves a higher value. Overripe fruits have very low levels of fruit acid and therefore lack in characteristic flavour. Exaggerated N doses depressed sugar content in chernozem with good potassium supply, in agreement with our former results (VÉGH ET AL., 2007). Vitamin C content decreases slightly during tomato ripening stages.

At harvest time N levels in sweet corn leaves and seeds were independent of N doses and soil types. The highest sugar content in sweet corn was measured due to manure treatment, while low and high N doses tended to decrease it

Combined use of nitrogen fertilizer and barnyard manure resulted the most beneficial effects on green and red pepper crop mass. The results confirm that nitrogenous compounds coated slightly on the surface of soil organic matter are more susceptible to decomposition and mineralization than the components not containing nitrogen, so the manure treatment has a statistically significant increase in N content and final crop yield (BALIK ET AL., 2003)

In our experiments alluvial soil with high mold content proved to be the most suitable for growing red pepper. Our results emphasize the importance of the ecological growing circumstances in agricultural growing.

ACKNOWLEDGEMENTS

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REFERENCES

BALÍK J., ČERNÝ J., TLUSTOŠ P., ZITKOVÁ M. (2003): Nitrogen balance and mineral nitrogen content in the soil in a long experiment with maize under different systems of N fertilization Plant Soil Environment 49(12): 554–559.

KÁDÁR, I. (2007): Sustainability of soil fertility nutrient levels. Cereal Research Communications 35: 573-576.

NÉMETH, T. (2006): Nitrogen in the soil-plant system, nitrogen balances. Cereal Research Communications 34: 61-65.

SZILI-KOVÁCS, T., CSERNI I., VÉGH K. R., RAJKAI K., NÉMETH T. (2009): Fertilizer Effect on Carbon Dynamics of Different Texture Soils under Tomato Cultures. Communications in Soil Science and Plant Analysis 40: 840-849.

VÉGH, K. R., RAJKAI K., SZILI-KOVÁCS T., CSERNI I., NÉMETH T. (2007): Nitrogen efficiency in tomato culture, Cereal Research Communications 35: 973-976.

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EVALUATION OF TRADITIONAL REGION-SPECIFIC FOODSTUFFS

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ABSTRACT
Oversupply of foodstuffs on the markets of developed countries is apparently a constant experience, which can alternatively be addressed with the differentiation strategy, namely offering unique and easily distinguishable products to a target audience with matching quality and specificity needs. Niche marketing is a viable strategy for small businesses to succeed.
The aim of this paper is to prove that the production of high quality local (Hungarian) traditional horticultural products can be a niche market besides the mass production.
The natural and social values of the traditional region-specific products have great market potential; the optimal exploitation of this potential, however, requires the enhancement of the competitiveness of these products as well as the intensification of the marketing activities that help the products enter the market and preserve their positions there.

Keywords: niche marketing, traditional horticultural products, quality

INTRODUCTION

Throughout history, prices have usually been determined between the sellers and buyers in price negotiations (bargains). Traditionally, consumer decisions and purchase decision making processes largely depend on price. However, non–price factors, e.g. product features, place of origin, communication, have been gaining significance in purchasing decisions over the past decades.
Niche marketing with the prospect of achieving success via exploring and tapping undiscovered but profitable niche markets is an appealing opportunity for many enterprises as small entrepreneurs hope that niche marketing helps avoid competition on a broad, mass market, thus enabling nice fat profit returns. Furthermore, numerous now large mass markets once started out as small niche markets with substantial growth potential (VAN DER HOPE, 2008). Niche marketing is hence a viable strategy for small businesses to succeed. Copying the factors that have turned several enterprises on the niche market successful, for instance "specialization", "maximum flexibility", "close customer relationships", "focus on core competences" or "solid product and technology know-how" does not suffice, though (ROSENBAUM ET AL., 2004).
Niches and niche strategies are closely interrelated and distinctive niche strategies resonate with different target niche markets. Consequently, each business has to assess its capacity and competence to develop a suitable strategy and successfully address the audience segment and ultimately, achieve lasting success on the niche market.
Oversupply of foodstuffs on the markets of developed countries is apparently a constant experience, which can alternatively be addressed with the differentiation strategy, namely offering unique and easily distinguishable products to a target audience with matching quality and specificity needs (HOMBURG ET AL., 2004). In terms of foodstuffs, this special and distinguishing character might derive from their revised and reinvented traditional tastes and combinations (ROTH, 2004), their link to the geographical place of origin

(BALABANIS ET AL., 2004) or their ecological production methods. Instead of targeting the mainstream market, these products all aim at satisfying the needs of particular minority market subgroups (niches). Special foodstuffs represent special quality due to their traditional nature, their roots in the region or their ecological production methods. The three pillars of the European Union's Common Agricultural Policy (CAP) reform related quality policy help the definition and identification of special products (PANYOR, 2007). No single economically or psychologically well based price setting method can be established for these traditional and region-specific foodstuffs due to the heterogeneity of the subject product group (KŐSZEGI, 2013).

MATERIAL AND METHOD

Material

Opinion survey is the most popular means of primary data collection and is still dominant in the field of marketing and sociological surveys. Quantitative research and questionnaire based survey form the primary source of my study; the questionnaires contain consumption and purchase related questions and background variables.

Some of the respondents volunteered to answer to my questions in their homes, with the participation of their family members. The age, educational attainment, occupation and place of residence of the respondents vary a lot. The interviews were conducted on various premises in order to obtain a largely representative sample.

Method

Horizontal vs. vertical niches. Niches can be vertical or horizontal and the main idea behind this differentiation can be traced back to the concept of evolution. The main difference between the two kinds of niche is highlighted below:

- Horizontal niches: minority market subgroups within or on the periphery of the larger marketplace; they trigger market compression.
- Vertical niches: new level of depth is built in the current market as a result of providing a highly specialized product or service that was not available before.

RESULTS

Assessment of the importance of quality and price for traditional region-specific foodstuffs

Purchasing decisions are seldom resolute; consumers are exposed to a certain level of risk in the purchase decision making process. The perception of the risk depends on the consumers' personality, the nature of the product or service and predominantly on the price. Our research investigates the consumers' perception of the quality and price of traditional region-specific foodstuffs. The respondents have been segmented on the basis of their gender, age and educational attainment, residence in order to examine whether the different segments respond differently.

The quality and price is almost equally important factors for both male and female respondents. Males are a little more price sensitive and females are slightly more quality sensitive. Many respondents claim that they purchase Hungarian foodstuffs due to their high quality *(Figure 1)*.

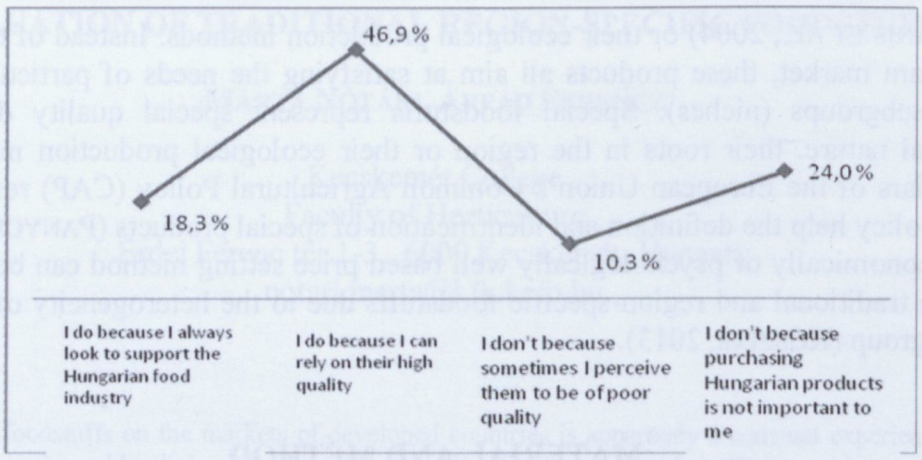

Figure 1. Conscious choice of Hungarian products

Consumers generally support linking outstanding product quality to specific regions (such as walnuts of California, wines of Bordeaux; Hungarian examples are onions of Makó, red paprika and paprika powder of Kalocsa and Szeged). With these products, consumers accept only the highest quality and they also demand special organoleptic characteristics.
Price obviously plays a key role in the purchase decision making processes; and as the products in the focus of our research are special quality ones, many consumers perceive their prices as a reflection of their heightened quality. The assessment by age group reveals significant differences (*Figure 2*), respondents below forty and over sixty profoundly take quality into consideration for their purchase decisions (80.1% on average), whereas quality is seemingly not so important for respondents in their forties and fifties (25.4%). The reason can be that this generation is fighting with the troubles of make both ends meet; they are highly affected by the economic crises, unemployment etc.

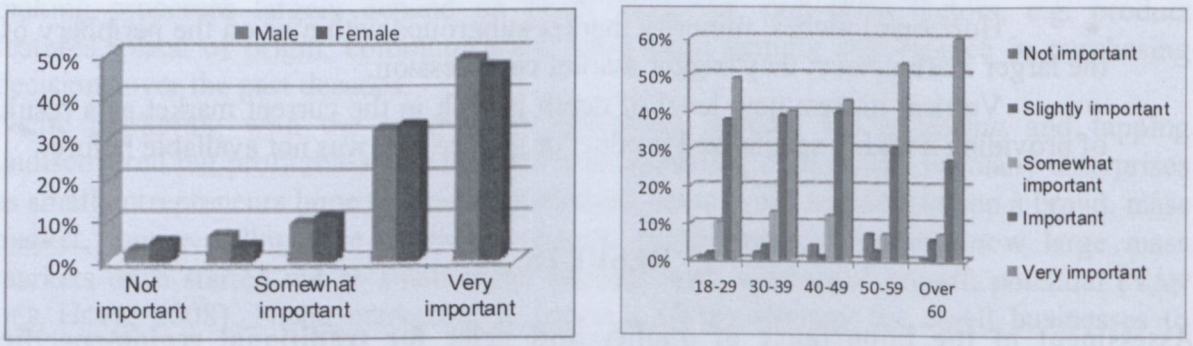

Figure 2. Assessment of the importance of price by gender (a) and age group (b)

Quality is in general a more important decision making factor for respondents with higher educational attainment (77.4%) than for those with low educational attainment (40%), though the importance of price in consumer decisions yields opposite results. Interestingly, the assessment by place of residence highlights the utmost importance of quality in the purchasing decisions of villagers as well as capital city inhabitants (100%). It may be due to the reason that living in the countryside people have more chance to meet and know fresh, homegrown products first hand, therefore they insist on the same level of quality during their purchase. For respondents from the capital, quality and price are equally important factors.
The findings of our research are on the system of values and preferences that seem to determine foodstuff purchases. Apparently, the influential factors for female customers are

the quality and product mix, whereas male customers seem to primarily focus on the producer and price; however, members of both sexes mainly find the price „tolerable".
Two third (65.6%) of the respondents buy Hungarian products mainly because of their perceived high quality (47.6%) ("I do because I can rely on their high quality") and supporting the local industry (18.3%). One third (34.3%) of the respondents do not consciously pay attention to the preference of Hungarian products in their purchasing decisions. This segment does not represent mathematical majority; however, this finding calls for further examination. In an attempt to target the above mentioned segment, the price differentiation strategy could be deployed to develop an efficient price strategy: with the aim to address consumer expectations; price differentiation strategy recommends price readjustment in relation to three dimensions, namely quality, product range and brand.
Figure 3 points out that approximately half of the consumers purchase Hungarian foodstuffs on the marketplace because this environment fosters personal contact between sellers and buyers; this finding thus highlights the significance of personal contact. Sales on the marketplace encompass various beneficial aspects: packaging has an insignificant marketing function, usually the producers themselves take care of the transport of the products and producers are in control of the entire production and sales process. The respondents opine that purchase of products originating from Hungary is ascertained in this scenario.

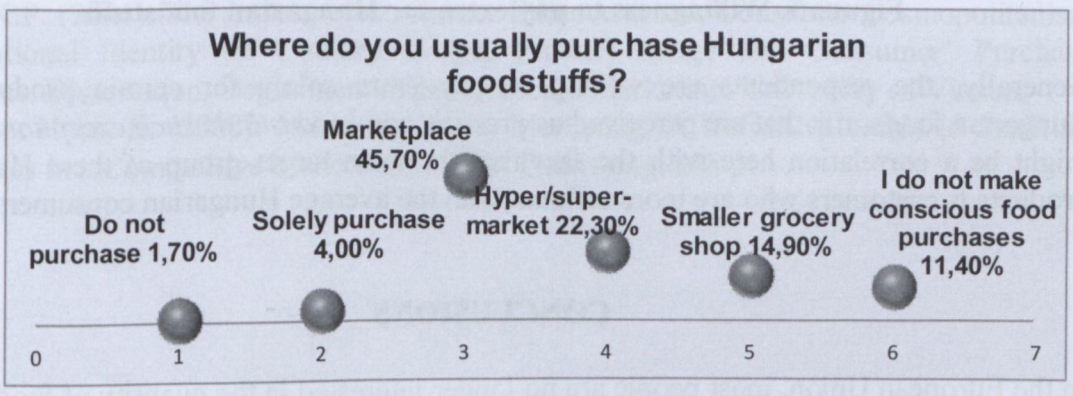

Figure 3. Food purchasing places in Hungary

About half of the respondents prefer purchasing expensive but traditionally manufactured products because they think the higher price guarantees that the product originates from a reliable source *(Figure 4)*.

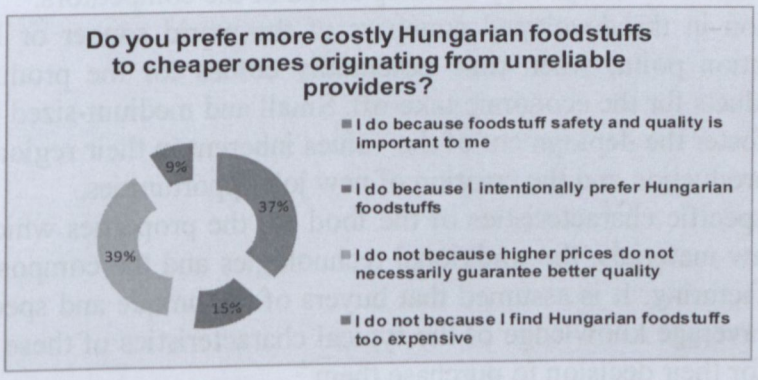

Figure 4. Aspects of the preference for Hungarian foodstuffs

Willingness to Pay Extra for Hungarian Foodstuffs

The research examines and assesses the willingness to pay extra for Hungarian products *(Figure 5).* Trademarks are more often required for traditional products because such labelling represents excellent quality. However, their availability is not as good as their competitors.

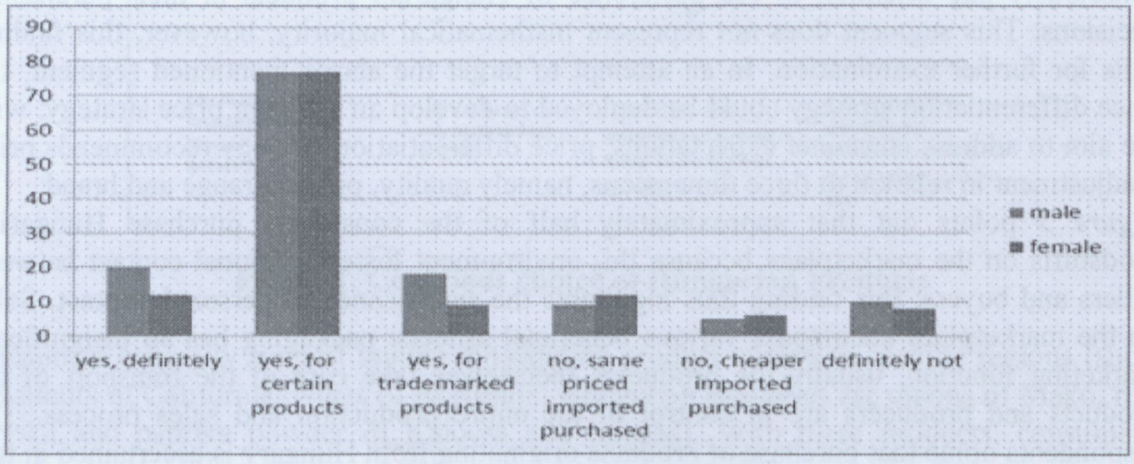

Figure 5. Willingness to pay extra for Hungarian foodstuffs

Generally, the respondents are willing to pay extra solely for certain products and Hungarian foodstuffs that are perceived as prestige goods *constitute such exceptions*. There might be a correlation here with the fact that the main target group of these Hungarian products is customers who are more affluent than the average Hungarian consumers.

CONCLUSIONS

In the European Union, most people are no longer interested in the quantity of food as they already have it. Rather, more and more, product specification is becoming relevant. The goal is to tap already profitable niches and discover new ones. Having discovered a new niche, the business aims at the maximum tapping of its potentials and securing long-term demand retention.

This strategy allows the further differentiation of the target group, thus building new and further specialized sets of niche markets (exploring new horizontal niche opportunities). Eventually the point is to always stay one step ahead of the competitors.

Food consumption in the developed countries of the world sooner or later reaches the biological saturation point, when time potentially comes for the production of special value-added products for the economic take-off. Small and medium-sized businesses are in key position to foster the deployment of the values inherent in their regions, the expansion of value-added production and the creation of new job opportunities.

The traditional specific characteristics of the food are the properties which originate with the traditional raw materials, the traditional technologies and the composition used in the course of manufacturing. It is assumed that buyers of the unique and specialized products have more than average knowledge of the typical characteristics of these products, as this forms the basis for their decision to purchase them.

The natural and social values of the traditional region-specific products have great market potential; the optimal exploitation of this potential, however, requires the enhancement of

the competitiveness of these products as well as the intensification of the marketing activities that help the products enter the market and preserve their positions there.

REFERENCES

BALABANIS, G., DIAMANTOPOULOS, A. (2004): Domestic Country Bias, Country-of-Origin Effects, and Consumer Ethnocentrism: A Multidimensional Unfolding Approach. Journal of the Academy of Marketing Science 32(1): 80-95.

HOFMEISTER-TÓTH, Á. (2013): Fogyasztói magatartás alapjai. Aula Kiadó, Budapest. 246 p.

HOMBURG, C., KROHMER, H., WORKMAN, J. (2004): A strategy implementation perspective of market orientation. Journal of Business Research 57(12): 1331–1340.

KŐSZEGI, I. (2013): Relationship between sustainable agriculture and rural development in Hungary. Annals of F.E.H. – International Journal of Engineering Vol. 7. No. 4.

PANYOR Á. (2007): Az élelmiszerfogyasztói magatartást befolyásoló értékrendek szerepe, Édesipar 53(2): 9-11.

ROSENBAUM, M., MONBEN, M. (2004): Nischenmarketing, Strategische Alternative zur Zukunftssicherung. Absatzwirtschaft 47(11): 28-33.

ROTH, K.P. (2006): The Impact of Consumer Ethnocentrism, Consumer Cosmopolitanism and National Identity on Country Image, Product Image and Consumer' Purchase Intentions. Dissertation, Department of International Marketing, University of Vienna.

VAN DER HOPE, E. (2008): Mastering Niche Marketing. A Definitive Guide to Profiting from Ideas in a Competitive Market. Globalnet Publishing. 308 p.

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THE ROLE OF CUSTOMER CONSCIOUSNESS FRAMING IN THE INCREASE OF THE MARKET SHARE OF THE TRADITIONAL FOODS

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ABSTRACT
Questionnaires were done for research of the local consumer evaluation aiming the topic of traditional horticultural products in the sphere of products in horticulture and food industry. We have three hypotheses: 1. The consumers are able to associate with messages bound up with characteristic, regional products. 2. In the decision-making process, in connection with the purchase and consumption of the consumer, the knowledge of the source of supply is an influential factor. 3. The product character of traditional horticultural products gives the chance to the consumer to acknowledge the excellent and individual feature of the product in a higher price, consequently, the higher price will be less influential factor in their decision-making process of the purchase. In the years 2010-2011 primary research has been conducted on agricultural and food manufacturers of traditional horticultural products. To analyse the survey data, we have used SPSS 14.0 for Windows and LISREL 8.30. Methods: Confidence-interval calculation, a variable structure test wit factor analysis, a variable structure test with cluster analysis, multi dimensional scaling and correspondence analysis.
It can easily be brought to light that the consumers select product not even on the basis of its price, appearance but rather on the basis of its particular taste and the excellent quality. The consumers regard - beside the perceptible attributes – the Hungarian provenance, place of origin and the traditional feature as an important aspect. In the analysis of traditional horticultural products we can divide two independent factors can be distinguished: quality and economic factors.

Keywords: Hungarian agriculture, production, price, quality, country image

INTRODUCTION

A new tendency of consumer attitude has been emerging with a shift from the simplistic perception of foodstuff as mere agricultural products towards a more complex perception where foodstuff also has a cultural dimension. According to SINI (2000), the associability of a product with a special purpose, tradition or place of origin gives rise to the adoption of this attitude. Products that can be easily associated with a particular culture or place of origin have the potential to create market gaps, thus a reverse tendency to consumer standardisation emerges (SZAKÁLY ET AL., 2008, 2010). In the case of foodstuff, the country image is of utmost importance due to the fact that consumers, besides building a specific mental image of a particular product, also tend to assign products positive or negative images of the country of origin.
The favourable geographical location of Hungary allows the production of foodstuff of high added-value and outstanding quality. Hungarian agricultural production areas generally enjoy wide international recognition; however, building a strong international image of Hungarian agricultural production areas needs product restructuring and technological innovation as well as a variety of other factors, such as the atmosphere of a particular agricultural production area, production related know-how or the history and traditions of the given region, can benevolently contribute to this image building.

MATERIAL AND METHOD

Market research: the opinion survey refers to information collection, whereby a small section of a group of numerous individuals or institutions is selected via professional sampling and this selected section is then interviewed (BAGLYAS ET AL., 2013). The primary market research consists of the gathering of original, previously uncollected information and data, whereby the collection is undertaken with a specific purpose. I sought the answer to various questions during recording, therefore each answer can be registered as a variable as they can take varying values within a certain number interval. These are the dependent variables because, depending on the respondents, the result will be different, too. The questions (variables) remain the same throughout the questionnaire and the interviewees (respondents) are referred to as cases (KŐSZEGI ET AL., 2013).

Paired t-test analysis

For paired t-tests, the same respondents are tested repeatedly, thus test series are conducted on the same respondents and the paired t-test is used to examine the differences. A variable for the differences observable in the pair is created and then the average and variance of this variable is calculated. Subsequently, the t-statistics is established. The degree of freedom is "n-1", where "n" stands for the even number of the examinations (PALLÓNÉ, 2007).

Pearson's Chi-squared test

The exact significance test is based on two hypotheses; one is referred to as null hypothesis and the other is as alternative hypothesis, respectively (DEÁK ET AL., 2010, 2011). The Chi-squared test uses the following formula:

$$X^2 = \sum_{i=1}^{2}\sum_{j=1}^{2}\frac{(f_{ij} - e_{ij})^2}{e_{ij}}$$

RESULTS

Independent Samples Test		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Conf Int of the Diff	
							Lower	Upper
viewpoints at the time of shopping FLAVOUR	Equal var assumed	-1.901	398	**0.058**	-0.139	0.073	-0.283	0.005
	Equal var not assumed	-1.889	377.997	0.06	-0.139	0.074	-0.284	0.006

Chi-Square Tests	Value	df	Asymp.Sig. (2-sided)
Pearson Chi-Square	**5.106[a]**	**4**	**0.277**
Likelihood Ratio	5.119	4	0.275
Linear-by-Linear Association	3.592	1	0.058

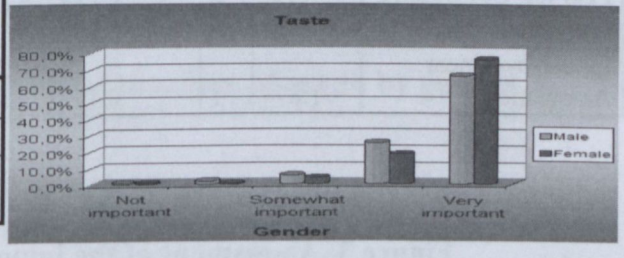


Figure 1. Assessment of the importance of taste by gender

Source: EDITED BY (2013)

Tukey B viewpoints at the time of shopping FLAVOUR			
educational level	N	Subset for alpha = 0.05	
		1	2
primary school	19	**4.21**	
skilled worker	26	4.54	4.54
grammar school/ technical college	222		4.63
college/university	133		4.65

Chi-Square Tests	Value	df	Asymp.Sig. (2-sided)
Pearson Chi-Square	**48.856[a]**	**12**	**0.000**
Likelihood Ratio	40.903	12	0.000
Linear-by-Linear Association	3.99	1	0.046

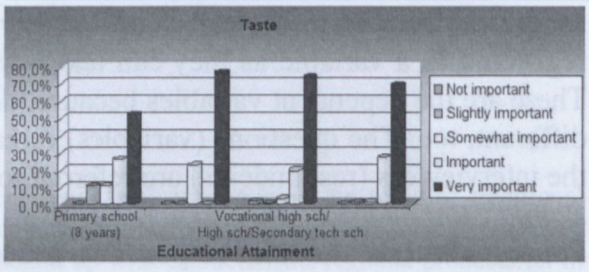


Figure 2. Assessment of the importance of taste by educational attainment
Source: EDITED BY (2013)

Quality has various components which can be communicated in a variety of messages. Taste, ingredients, high quality and traditional production methods are all related to the attitudes associated with Hungarian foodstuff. Our research examines the importance of taste for making decisions on the purchase of traditional products. The respondents have been segmented on the basis of their sex, age and educational attainment (*Figures 1-2*) in order to examine whether these factors influence the outcome of the purchase decision making process. No significant difference can be identified; the respondents obviously find taste either important or very important.

Independent Samples Test		t-test for Equality of Means						
		t	df	Sig. (2-tailed)	Mean Difference	Std. Error Difference	95% Conf Int of the Diff	
							Lower	Upper
viewpoints at the time of shopping TRADITION	Equal var assumed	1.370	398	0.171	0.486	0.354	-0.211	1.183
	Equal var not assumed	1.310	208.322	0.192	0.486	0.371	-0.245	1.216

Chi-Square Tests	Value	df	Asymp.Sig. (2-sided)
Pearson Chi-Square	**10.075[a]**	**5**	**0.073**
Likelihood Ratio	10.965	5	0.052
Linear-by-Linear Association	1.874	1	0.171

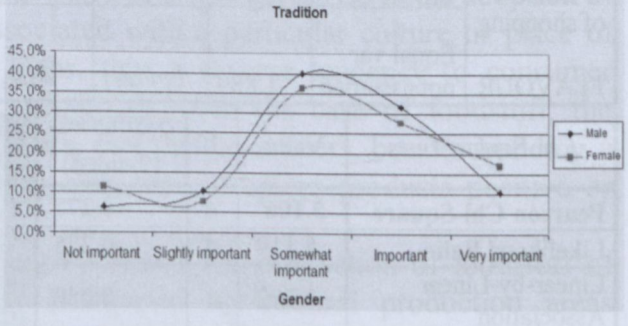


Figure 3. Assessment of the importance of tradition by gender
Source: EDITED BY (2013)

The added value of unique, high quality, region-specific foodstuff is partly owing to their traditional nature. As the specificity of a product does never originate only from a single component, the traditional nature also gains its significance in a specific component

context. All respondent segments evaluated this quality dimension as important or somewhat important. In a broader context, the traditional nature is a cultural asset and a certain consumer segment expects purchasables to have this added value (*Figures 3-4*).

Tukey B viewpoints at the time of shopping TRADITION		
educational level	N	Subset for alpha = 0.05
		1
primary school	19	2.68
skilled worker	26	3.19
grammar school/ technical college	133	3.29
college/university	222	3.81

Chi-Square Tests	Value	df	Asymp.Sig. (2-sided)
Pearson Chi-Square	**27.433[a]**	**15**	**0.025**
Likelihood Ratio	27.743	15	0.023
Linear-by-Linear Association	0.025	1	0.874

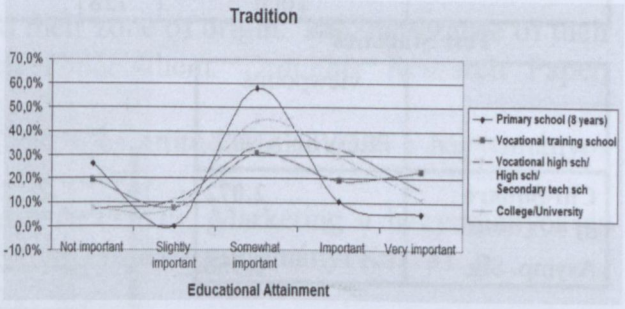
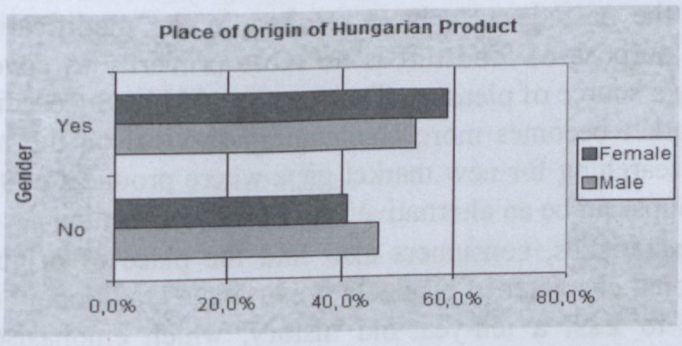


Figure 4. Assessment of the importance of tradition by educational attainment
Source: EDITED BY (2013)

Mann-Whitney	gender	N	Mean Rank	Sum of Ranks
viewpoints	Man	60	62.63	3758
	Woman	68	66.15	4498
PROVENANCE	Total	128		



Test Statistics[a]

	viewpoints Provenance
Mann-Whitney U	1928
Wilcoxon W	3758
Z	-0.622
Asymp. Sig. (2-tailed)	**0.534**

Figure 5. Assessment of the importance of the place of origin by gender
Source: EDITED BY (2013)

The European Commission sets two criteria to differentiate regional products from other products. One such criterion is quality or fame attributable to the place of origin, the other is the identifiability of the product name with the place of origin. The importance of the place of origin incorporates traditions and region-specific production technology. As shown above, the place of origin is a more important decision making factor for female consumers (59 percent) than for their male counterparts (*Figure 5*). The assessment by age group points out that the place of origin plays an important role for seniors (over 60) in their purchase decisions. *Figure 6* reveals that 60 percent of the respondents with low

educational attainment do not take the place of origin into consideration for their purchase decisions.

Kruskall-Wallis

	educational level	N	Mean Rank
viewpoints PROVENANCE	primary school	10	54.1
	skilled worker	5	66.9
	grammar school/ technical college	60	62.63
	college/university	53	68.35
	Total	128	

Test Statistics[a,b]

	viewpoints PROVENANCE
Chi-Square	**2.072**
df	3
Asymp. Sig.	**0.558**

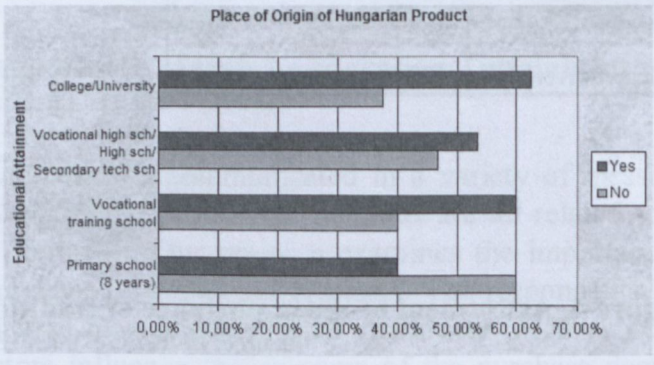


Figure 6. Assessment of the importance of the place of origin by age group
Source: EDITED BY (2013)

CONCLUSIONS

- The significant changes in the attitude towards food consumption in the developed industrialised countries over the past decades have resulted in the modification of consumer habits as well; the purpose of foodstuff is no more primarily to cover our material needs but it is equally a source of pleasure (DEÁK ET AL., 2011). Succeeding on the overbought globalised market becomes more challenging, survival on the market requires novel methods, thus searching for new market gaps where products of special qualities can target special groups can be an alternative way of this succeeding.
- Beyond the perceivable characteristics, consumers also find the place of origin (the source region) and the traditional character of products important. "Traditional" means that the product looks back to least a ten-year-old history, which emphasises the importance of the time aspect. Analytical methods help little to assess the special characteristics of traditional and region-specific products but the consumer survey reveals that these factors play a significant role in the consumers' judgement on value. The communication of these special values towards the consumers for the purpose of enhancing the profile and competitiveness of the products is of utmost importance. Special, traditional foodstuff has a lot to offer to the ever growing consumer segment which craves for products with embedded emotional messages. These emotional messages are to be conceived region-specifically and communicated in plain language.

REFERENCES

BAGLYAS, F., DOBOS, N., KŐSZEGI, I. (2013): Dry flower consumer behaviour in Hungary. Review on Agriculture and Rural Development 2(1): 126-130.

DEÁK, ZS., HAJDU, I-NÉ (2011): Az élelmiszer-ipari vállalkozások környezeti teljesítménye és a pénzügyi eredmények. Gazdálkodás 5(7): 662-667.

DEÁK, ZS., HAJDU, I-NÉ (2010): Fenntartható fejlődés és a fogyasztói társadalom. Agrár- és Vidékfejlesztési Szemle 5: 516-521.

KŐSZEGI, I., BAGLYAS, F. (2013): Trade-off analysis in a wine market research in Hungary. Review on Agriculture and Rural Development 2(1): 120-125.

PALLÓNÉ KISÉRDI, I. (2007): Hagyományos és tájjellegű termékeink európai szintű hasznosítási stratégiája. EOQ MNB, pp. 4-20.

SINI, M.P. (2000): Typical local products and their zone of origin: The importance of their reevaluation emphasizing the links which connectthem. Dolphins Research Paper, http://www.origin-food.org/dol

SZAKÁLY, Z. ET AL. (2008): Fogyasztói szokások és attitűdök elemzése a hagyományos élelmiszerek piacán. Kutatás jelentés

SZAKÁLY, Z., PALLÓNÉ KISÉRDI, I., NÁBRÁDI, A. (2010): Marketing a hagyományos és tájjellegű élelmiszerek piacán. Kaposvári Egyetem Gazdaságtudományi Kar. 31. p.

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TRADITIONAL HORTICULTURAL PRODUCTS FOR THE ANALYSIS OF IMAGE PROFILE THE EXAMINATION OF CONTROL

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ABSTRACT

Questionnaires were done for research of the local consumer evaluation aiming the topic of traditional horticultural products in the sphere of products in horticulture and food industry. We have three hypotheses: 1. The consumers are able to associate with messages bound up with characteristic, regional products. 2. In the decision-making process, in connection with the purchase and consumption of the consumer, the knowledge of the source of supply is an influential factor. 3. The product character of traditional horticultural products gives the chance to the consumer to acknowledge the excellent and individual feature of the product in a higher price, consequently, the higher price will be less influential factor in their decision-making process of the purchase. In the years 2011-2012 we conducted primary research on consumers of traditional horticultural products. According to the results it can easily be brought to light that the consumers select product not even on the basis of its price, appearance but rather on the basis of its particular taste and the excellent quality. The consumers regard – beside the perceptible attributes – the Hungarian provenance, place of origin and the traditional feature as an important aspect.

Keywords: traditional product, horticulture, quality, sour cherry, onion, apricot

INTRODUCTION

A region's competitiveness can be ensured basically by its features and the development of demand by utilizing the competences manifested in various areas. Under the concept of competence we understand the represented skills and expertises of a particular region and municipality. These refer to "connate" natural, geographical, historic, human capabilities; activities based on these; and the quality of operations.

Only a versatile, nationally significant and internationally recognized competitive region, with a specific image, is able to realize benefits based on differences in the production conditions. In this case, specialization may be the condition for economic growth. The higher degree of specialization, combined with efficiency of the resources used, the greater the economic growth is to be expected. The implementation of specialization is based on the principles of absolute and comparative advantages. The comparative benefits arise from the fact that a region is specialized in the production of certain products, which have the greatest comparative advantage in creation. As is the case in several European Union countries, in some rural areas of Hungary - where this is justified by the environmental conditions - the development and concentration of resources are focused especially on regional products (SZENTE AND SZAKÁLY, 2006). It supports the marketing of the local specialized foods and the advancement of the production sites. The "Terroir" is regarded as the local incarnation of permanence. The "place" is embedded into the product and this is the source of identity of the locally made product (ILBERY AND KNEAFSEY, 2007).

Today's contradiction is the "global-local paradox." While global competition is continually on the increase, companies are concentrated in regions where the local environment provides favourable conditions for competition in the industry. The reason is

that between the long-term corporate competitive advantages the locality based benefits provide increasing revenues (HERMAN AND ANDERS, 2001).

MATERIAL AND METHOD

Material

In the years 2011-2012 primary research was conducted among the traditional horticultural products as well as among the food producers and consumers. The goal was the establishment of a representative sample. Before the survey for traditional Hungarian horticultural products was distributed to customers and consumers, we set up a sample plan in order to process, categorize and weigh the required data. 850 questionnaires were prepared and divided up. We subsequently entered into the system 672 pieces of questionnaire data.

Methods

The market research studies were designed to acquire the necessary informational background for the decisions of the market, and to reduce the inherent risk in company's decisions. The advantage of the **secondary** data collection is that it helps to determine the specific task and thus the conditions for development of the primary research (PISKÓTI, 2002). The **primary** information gathering means would ensure proper data collection, processing and evaluation, serving the aims of the researcher. The survey is the most widely used procedure, which allows the gathering of any type of information. The most important phase of the preparatory work was related to the research for determining the need for information.

The **Stapel scale** differs from the semantic differential scale in that it has one pole, and only one endpoint (LAKNER ET AL., 2007). In our research using the Stapel scale, the respondents revealed by an adjective or descriptive indicator the extent to which the specific regional horticultural products grown in Hungary meet their satisfaction and the criteria for quality in the consumer's opinion.

RESULTS

Sour cherries from Kecel

Recommended marketing tools for the management of the special quality with respect to sour cherries from Kecel based on the consumer's opinion about them (for details see *Fig. 1*) are the communication of the specific processing and marketing methods. The package (100-200-500 g / dose): modernizing of the packaging to aid in fresh consumption as well as impulse buying, and ensuring that the integuments are suitable for displaying the product information, which shall include the place of origin, individual properties and the nutritional criterion to help facilitate consumption. For consumers, the most important features of the products are its excellent taste, long shelf life and versatility. They are less aware of its special quality. It is proposed that the appropriate marketing communicative subtitles be placed on the packages of the sour cherry. Producers would require assistance in order to have an image-oriented marketing strategy for the sour cherry from Kecel. It may be useful to establish a traditional goods trademark, which they would need to support financially as well. Hungarian communal agricultural marketing should locate the points where they could market these excellent Hungarian products.

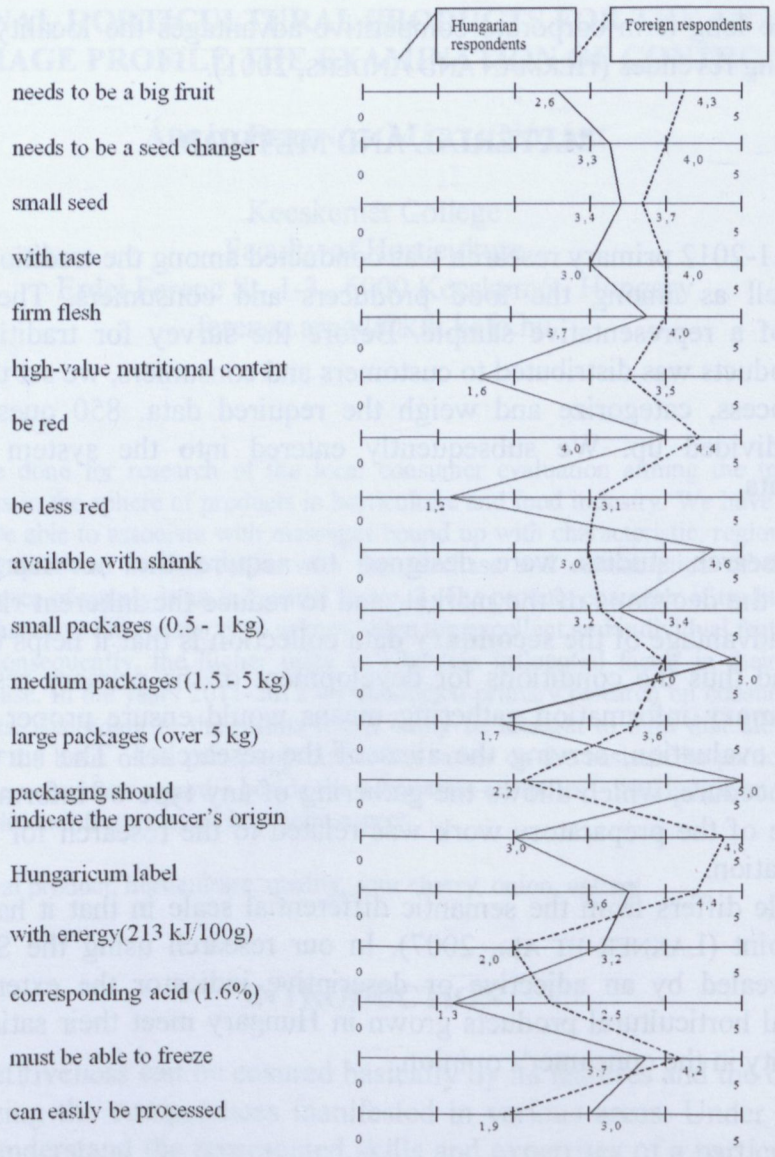

Figure 1. Consumer's opinion about the quality of the sour cherry from Kecel in Hungary

Apricots from Kecskemét

Proposed marketing tools to maintain and manage the special quality of apricots from Kecskemét are organising regional awareness-raising events with the focus being the communication of the goods and processed products and their benefits. For example, the product can be utilized in versatile ways. It is home-processed in bulk. Furthermore, the notoriousness of the product can be increased by presenting the area's traditional processing methods, along with the domestic products. The opinions of the respondents can be seen on *Fig. 2.* The raw and processed products should be highlighted with information to consumers emphasizing the origin and the unique flavour of the product. It must be initiated that the processors indicate the origin and the variety also on the large-scale products. In recent years, the sales structure of apricots' has changed significantly. Fresh consumption and export sales have been growing while pulp production has been reduced.

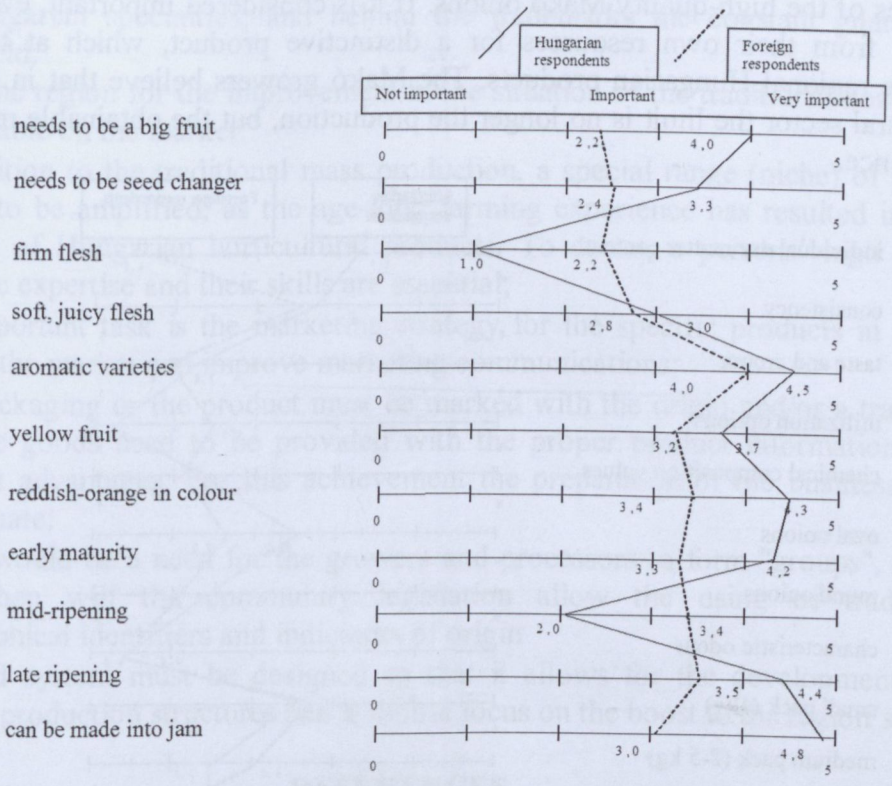

Figure 2. Consumer's opinion about the quality of the apricot from Kecskemét in Hungary

We would need to plant late-ripening varieties suitable for fresh consumption and capable of sustaining dehydration because on the market these are the "gaps" where it would be possible to gain ground. In the Kecskemét region apricots are grown in large quantities because there is a large demand for them and the growers have significant professional dedication. They consider the development of a traditional product trademark important and would be willing to sacrifice from their own funds in order to finance it. They would also support the establishment of a specialized commercial network, which would only trade in Hungarian and regional products. In addition, it would be necessary to communicate more effectively the uniqueness and high quality of the Hungarian horticultural products at international exhibitions and it would be necessary for the obtained information to be accessible in time.

Onions of Makó

The opinions of the respondents can be seen on *Fig. 3*. In order to increase the sales of packed products, besides the indication of origin information, it is necessary to communicate the therapeutic effects and the possible uses of the product. It is necessary to convince the large food processors to indicate their products' origin on the label (for example, the product contains original onions from Makó or the product is made from Makó onions).

Production of these special onions has decreased in Hungary because the dry-product-industry capacity has declined and, just as importantly, because fewer and fewer can afford the high production costs. The profitability of the product varies each year because of the unpredictability of the market. This product is suitable for demanding consumers, but the majority of lower earning consumers have a preference for a cheaper product. Thus it would be essential to provide the customer with additional information about the unique

properties of the high-quality Makó onions. If it is considered important, even they would sacrifice from their own resources for a distinctive product, which at the same time promotes regional Hungarian products. The Makó growers believe that in the Hungarian agricultural sector the limit is no longer the production, but the obtainable market size and permanence.

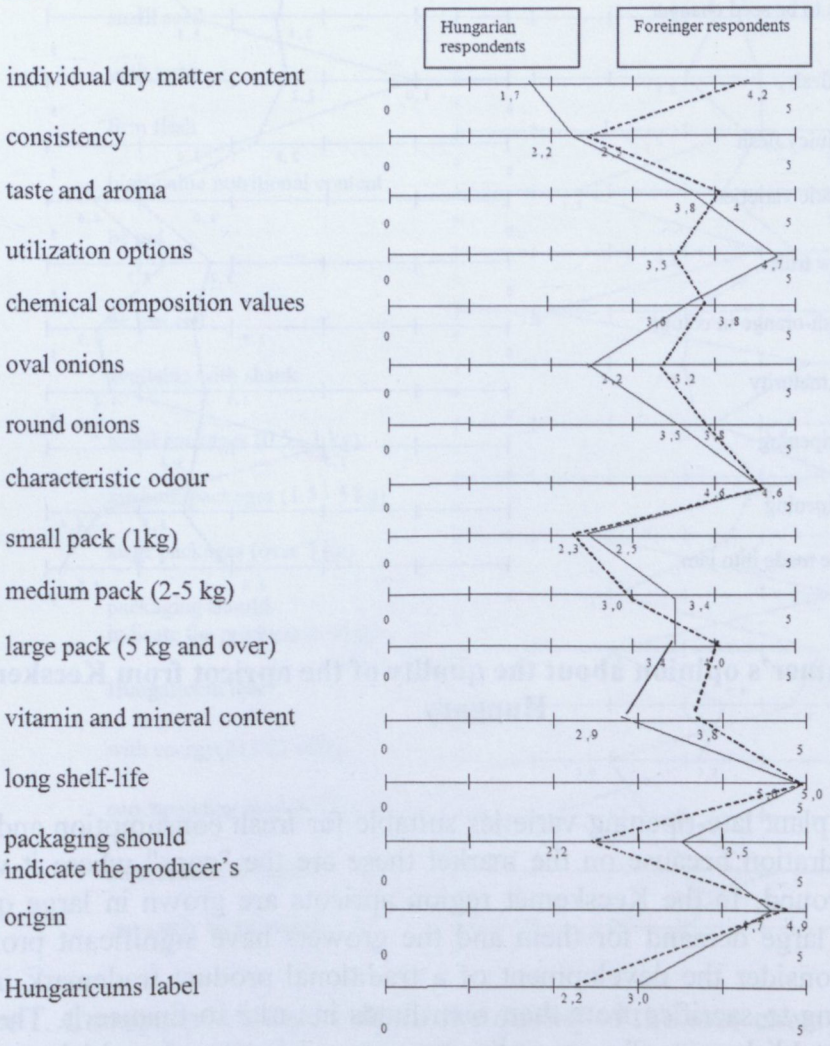

Figure 3. Consumer's opinion regarding the quality of the onions from Makó in Hungary

CONCLUSIONS

In Hungary, one of the problems facing the Southern Great Plain is the fact that there are a relatively few number of homogeneous aspects determining widely known individual products, so they exist in isolation. However, numerous region-specific garden products are present here, which are suitable for the preservation of local traditions and the development of the region's image. The selection of the range of these products, effective management, and protection via the tools of an active marketing policy can actively help with the Southern Great Plain's positive image influence. Facilitating stabilization in the specialized production areas, strengthening of the local economy and improved consumer income, and the key elements of the Southern Plain region's marketing strategy could be those region-specific products (E.g., Kecskemét's apricot brandy), which meet stringent standards and expectations. It is important that the region's unique products remain

authentic Hungarian specialties, and behind the trademarks the constant guarantee of quality is upheld.

The tasks of the region for the improvement in the situation of the traditional horticultural products available on the market:

- In addition to the traditional mass production, a special range (niche) of products needs to be amplified, as the age-long farming experience has resulted in a high quality of Hungarian horticultural products. To do so, a persons' high level of specific expertise and their skills are essential;
- An important task is the marketing strategy for the specific products in order to access the market and improve marketing communications;
- The packaging or the product must be marked with the origin and/or a trademark, and the goods need to be provided with the proper product information stating product advantages. For this achievement the preparation of the business side is inadequate;
- There would be a need for the growers and processors to form "groups", because only then will the community legislation allow the using of trademarks, geographical identifiers and indicators of origin
- The aid system must be designed so that it allows for the development of the special production structures and it should focus on the boost to the region's values.

REFERENCES

HERMAN, R., ANDERS, S. (2001): Potentiale und Erfolgsfaktoren Regionaler Markenprogramme in Mittel-Europe. Jahrbuch der Absatzt und Verbranchsforschung 47: 251-270.

ILBERY, B., KNEAFSEY, M. (2007): Producer consructions of quality in regional speciality food production. Journal of Rural Studies 23: 217-222.

LAKNER, Z. , HAJDU-BALOGH, D., KAJÁRI, K., KASZA, GY. MÁRKUSZ, P., VIZVÁRI, B. (2007): Versenyképes élelmiszergazdaság – élhető vidék. Gazdálkodás 4: 1-13.

PISKÓTI, I. (2002): Régió- és település marketing. KJK Kerszöv Kiadó, Budapest. p.31 41.

SZENTE, V., SZAKÁLY, Z. (2006): Az élelmiszer-fogyasztói magatartás trendek vizsgálata kiemelt figyelemmel a stratégiai élelmiszerekre. Élelmiszer, táplálkozás és marketing 3: 3-11.

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STUDY ON A GASTRO-TOURISTICAL PROJECT IN THE HUNGARY-ROMANIA CROSS-BORDER CO-OPERATION PROGRAMME

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ABSTRACT

The objective of this study is the discussion of the experiences on a Hungary-Romania cross-border project which was implemented in Arad, Békés, Csongrád and Timiş counties in 2012-2013. University of Szeged, University of Agricultural Sciences and Veterinary Medicine of the Banat in Timişoara and two Romanian and one Hungarian farmer associations were involved in collecting special local products and recipes, traditional cultural and gastronomic events, as well as restaurants and accommodations. As coordinators of the project we gathered several experiences. SWOT analysis was carried out to understand the circumstances and the advantages and disadvantages of the regions. The main conclusion of our experiences was the following: it seems there are more things which are connect than which are separate people in this border regions.

The project was financed by the HU-RO CBC Programme (The role of special local foods and events in development of local tourism – HURO/1001/213/2.1.2 – FEDERTO).

Keywords: rural tourism, Hungary-Romania, cross-border co-operation, project management

INTRODUCTION

In whole Europe the SMEs in agriculture try the diversification of their activities. Beside the animal, plant and horticultural production they focus on complementary activities, in most cases on rural tourism (HORVÁTH, 2009). In the Hungarian rural areas the most important strategic goal is the development of tourism based on the local thermal water and the joint services (VÁNTUS ET AL., 2012). The development of tourism is a complex objective helping it by establishing and improving the relating facilities. These facilities make easier not only the life of local inhabitants and serve employment, but many of them make the rural areas more attractive even for tourists (SZABÓ AND POSTA, 2012).

The purpose of development remains unchanged: to offer for tourists accommodation and gourmet specialties in rural areas, at affordable prices in a beautiful 100% natural area (CIOLAC ET AL., 2011). Regarding the good quality products local farmers markets could be good solutions contributing to the increased number of visitors. The implementation of developments easier with the aid of projects.

Projects involve uncertainty. At the beginning of a project, the exact amount of time that will be needed is not known, nor is the precise amount that the project will eventually cost. For some projects, it is even uncertain whether the intended goal will be reached at all (BAARS, 2006). The triangle of time-quality-cost shows the trade-offs inherent in any project. Time is the available time to deliver the forces in a project. Cost represents the amount of money or resources available and quality represents the "fit-to-purpose" that the project must achieve to be a success. The normal situation is that one of these factors is fixed and the other two will vary in inverse proportion to each other. For example "Time"

is often fixed and the "Quality" of the end product will depend on the "Cost" or resources available. Similarly if you are working to a fixed level of "Quality" then the "Cost" of the project will largely be dependent upon the "Time" available (if you have longer you can do it with fewer people) (JENKINS, 2006).
The aim of this study was the evaluation of cross-border cooperation with the help of a case study.

MATERIAL AND METHOD

The aim of this paper is the discussion of the experiences on a cross-border project which was implemented in Arad, Békés, Csongrád and Timiş counties. The partners were:

- Two universities: University of Szeged Faculty of Agriculture (LP) at Hódmezővásárhely and University of Agricultural Sciences and Veterinary Medicine of the Banat at Timişoara;
- and farmer associations were involved:
  - Farmers Association of Orosháza,
  - Association of Hungarian Farmers of Arad County,
  - Association of Farmers and Entrepreneurs of Bansag.

The objectives of the CBC project were collected as special local products and recipes, cultural and gastronomic events, as well as restaurants and accommodations. SWOT analysis was carried out to understand the circumstances and the advantages and disadvantages of the situation.

RESULTS

All the partners knew each other from other projects or other type of bilateral co-operations (*Table 1*). The partners had a strong willingness to implement the tasks which were decided in the application. The members of Project Management Group were delegated by every single partner.
Universities have complete facilities and experience for organising events, to do the documentation of professional work and to fit to financial rules. The collected material will be used also for educational purposes in the teaching of rural tourism by the intent of the partner universities.
The farmers associations have a great number of members, so the collecting of data was easier than it was planned, but the organisation of uniformity of data records, and the description and translation of folksy idioms were more difficult than it was imagined before. Sometimes the collection of data needed too much time, because the information of the persons who served data was complete about the project goals. Several local cultural and traditional event were collected to an event calendar which can be a database for those who would like to look for some attraction in the neighbourhood or spend a weekend in a familiar community and enjoy the hospitality of the hosts and the new/old taste of the local products and dishes. Some of the events (first of all religious celebrations) were reintroduced after a four decade break, so it is necessary to extend them for the young generation.
The outputs of the projects are the following. Meeting of entrepreneurs/specialists in all counties (Hódmezővásárhely, Arad, Timişoara and Orosháza). News and interviews about

our project activities in the media. All results are published in three books on two languages (Hungarian and Romanian):

- Gastronomy and local products in four counties of the Hungary-Romania cross-border region.
- Gastronomic and local events in the four examined counties.
- Restaurants and accommodation in the four examined counties.

The books will be passed to entrepreneurs, local libraries, tourist information points and to university students. All data are also represented on the project website (www.federto.eu).

Table 1. SWOT analysis of the project

Strengths	**Weaknesses**
• The goals were decided together with the partners. • The partners knew each other. • Universities had staff, experience and place for project work and events. • Professional and financial support. • Resolve in implementation. • Most of the partners could speak Hungarian, but all of them knew English so it was the language for communication of the project.	• Civil partners had no enough experience in project management. • No permanent staff at civil organisations. • Members of civil partners has always a job with a priority (e.g. at summer for farmers). • Translation of professional texts. • Not easy to agree in appointments to prepare project events which fit to each partners.
Opportunities	**Threats**
• Get acquainted with several farmers and entrepreneurs. • Preparation of new projects. • Co-operation with local decision makers, stakeholders. • Realize stronger cooperation between the partners and farmers, and among the farmers and entrepreneurs. • Project events are good possibilities for the promotion of local values. • Easy to continue the data collection and extend the database during the following maintenance period.	• Only one year for the project (short time). • Farmer organisations sometimes are influenced by policy. • There was a temptation to implement a "Hungarian-Hungarian" project. • It is easy to cause pique if we do not know enough about each other culture, traditions and religious rules. • When the visited enterprises do not have proper or enough information about the project aims, they do not want to appear in the database.

CONCLUSIONS

During the project lifetime the different organisations get a financial and professional support for their activities. The partner from Arad county won a special advantage: they could rebuild their staff to a team.

Cross-border co-operations could have a synergetic effect on the introduction of different cultures, traditions and the people of the different micro regions and bring closer of the nationalities. The main conclusion of our experiences was the following: it seems there are more things which are connect than which are divide us in this region.

ACKNOWLEDGEMENT

The project was financed by the HU-RO CBC Programme of the European Union (The role of special local foods and events in development of local tourism – HURO/1001/213/2.1.2 – FEDERTO). Thanks for all project participants for their efforts.

REFERENCES

BAARS, W. (2006): Project management handbook. Data Archiving and Networked Services, The Hague

CIOLAC RAMONA, CSOSZ I., PET ELENA, MARTIN SIMONA, DINCU ANA MARIA (2011): Research on the features witch customize areas with developed agrotourism from Central Region of Romania. Lucrări Ştiinţifice Management Agricol, Seria 1, 13(4): 103-108.

HORVÁTH, J. (2009): Falusi turizmus Norvégiában és Izlandon. AgrárUnió 10(4): 18-21.

JENKINS, N. (2006): A management primar. www.nickjenkins.net

SZABÓ BERNADETT, POSTA, L. (2012): Natural, social and economic examinations of ecovillages focusing on a certain example. Review on Agriculture and Rural Development 1(2): 510-518.;

VÁNTUS, A., PAKURÁR, M., OLÁH, J. (2012): A foglalkoztatottság helyzete és kitörési pontjai a karcagi munkaerőpiac területén. A Virtuális Intézet Közép-Európa Kutatására Közleményei, 4, 2 (8): 17-24.

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EFFECTS OF ARSENIC CONTAMINATION IN SPRINKLING WATER ON THE ARSENIC CONTENT OF LETTUCE IN HYDROCULTURE

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ABSTRACT

Horticulture, and mainly vegetable growing, is one of the most important sectors of agriculture in Hungary. The production area of indoor and outdoor vegetable growing exceeds 60 000 ha per year. About 80 percent of this area is located in the southeast region of the country. The average precipitation of this area is 380-450 mm per year, therefore intensive vegetable growing can't avoid irrigation. However, sprinkling water is relatively available in this territory. Underground water for irrigation between 30 and 200 m is obtainable in good quality and quantity for all agricultural production. In some cases higher salt content and iron level appear in underground waters, and beyond these, higher arsenic concentration can be observed probably from geological origin. Main arsenic ion form is arsenate, which was concentrated in living water residues in Pleistocene and Holocene. In these waters arsenic concentration is 20 to 200 µg/L. In Faculty of Horticulture, Kecskemét College, we started our investigations in order to study the arsenic uptake and accumulating properties of different vegetables, grown under the influence of arsenic polluted sprinkling water. Our methods were indoor and outdoor growing, rainfall and trickle irrigation, soil and hydroculture manner as well. This paper summarizes our results on hydroculture lettuce grown with 0-25-50-75-100-200 µg/L (natural As dose) and 400-600-800 µg/L (provoked As dose) arsenic polluted sprinkling water.

Keywords: arsenic pollution, lettuce, greenhouse, hydroculture, hidroponically, ICP-AES

INTRODUCTION

Arsenic (As) is a well known toxic element found in Hungarian well waters due to natural geological conditions (FÜGEDI ET AL., 2004). In the EU-countries as well as in Hungary government decrees [201/2001 (X.25.)] determine the acceptable concentration of arsenic in drinking water (10µg/L, at most) and food of vegetable origin (vegetables, 200 µg/kg) [17/1999 (IV.16.) EüM]. Serious problems in the water supply of Hungary are caused by wells bored in some parts of the country which yield polluted water of 30-150 µg/L As concentration (BARTHA, 2004).

Due to these measures the impact of polluted water on the population can be reduced, but it must not be forgotten, that in the southern and south-eastern parts of the country fresh vegetables irrigated with arsenic water can threat the consumers directly.

It is clearly known from geological research (BARTHA, 2004), that underground waters in southern and south-eastern parts of the Great Plain contain arsenic in high concentration (30-200 µg/l). This area represents 80% of the irrigated vegetables territory.

The inorganic forms of arsenic are dangerous poisons noxious to the whole human body, reducing the activity of the nervous system, kidneys, respiratory organs and the liver, also resulting in reproductive and genetically anomalies and cancer (FERGUSSON, 1991).

Trial series were started in cooperation between the Ornamental Plant and Vegetable Crops Institute and Soil and Plant Analysis Laboratory of the College for Horticulture (Hungary, Kecskemét) to determine the concentration of this toxic element in some important vegetables irrigated with polluted water. Leaf-vegetables, pepper, tomato, carrot and

parsley have been tested from 2006 onwards followed by hydroponic lettuce in 2009, 2010 and 2011. Lettuce is grown on about 2000 ha, half in the open and half in forcing-house. The water used for irrigation or for nutrient solutions is obtained from wells, 30-100 m deep (BARTHA, 2004).

Aim of trials to analyze the effect of water with arsenic content characteristic for the region on lettuce leaves grown in hydroculture, when polluted water is used for the nutrient solution. Arsenic doses of 25, 50, 75, 100, 200, 400, 600, 800 µg/L were tested. The first five doses represent concentrations found in nature, the extreme values (400-600 µg/L) served for scientific observations or modelled extreme conditions.

MATERIAL AND METHOD

Trials included lettuce in hydroponic culture in the greenhouse of the Ornamental Plant and Vegetable Crops Institute. There were three tables each containing three nutrient channels made of plastic plates, 4.3 m long, 15 cm high and 30 cm large.

In each channel 25 l standard solution was circulated by a pump controlled by a time switch. An upper container (feeder) and a bottom container (collecting) facilitated the storage of the solution. The slight sloping of the channels furthered the solution flow. In the hydroculture roots developed in the solution and plants were fixed in a neutral agent, rock-wool, and cubes.

The hydroculture started 1st September 2009, 29th March 2010 and 11th April 2011. Two-four leaf lettuce was pricked into rock-wool cubes. The growing period lasted 6 weeks in each year.

At the end of the trial period the lettuce heads were removed from rock-wool cubes. Random samples were taken on the whole length of each channel, fully developed healthy leaves were taken from the middle of the heads in four repetitions.

Root samples were also collected by lifting the rock-wool cubes and disentangling the roots carefully.

The solids content in leaves and roots were determined by drying (70 ^{0}C) and homogenizing samples in a mill up to air dry stage. Samples were digested in a microwave device by means of concentrated nitric acid and hydrogen peroxide. Element contents were evaluated in an ICP-AES spectrometer.

RESULTS

According to classical analytical methods the arsenic content of samples was determined from the solids content. It must not be forgotten, however, that parts of vegetables (in lettuce the whole foliage) have very high water content. In our solids calculations the solids content of the samples varied between 3.05 and 5.82 m/m% with an average of 4.06 m/m%.

Relevant rules [17/1999 (IV.16.) EüM] allow 0.200 mg/kg arsenic in vegetables for fresh consumption at original water content. The value of arsenic concentration measured in lettuce solids should be divided by 25 to obtain the arsenic concentration of the plant at original water level.

Figures 1-3 represent arsenic concentrations in the three years and average of repetitions.

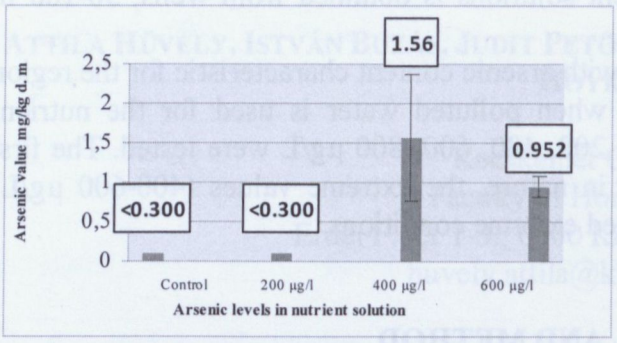

Figure 1. As levels in leaves referring to solids, mg/kg (2009)

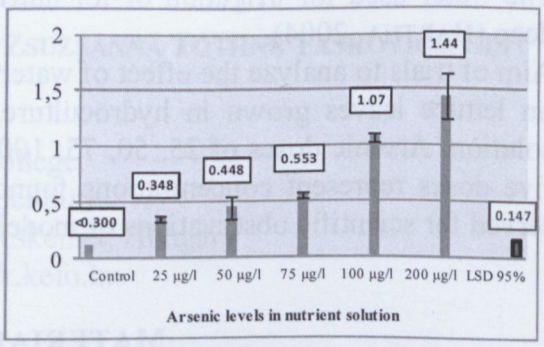

Figure 2. As levels in leaves referring to solids, mg/kg (2010)

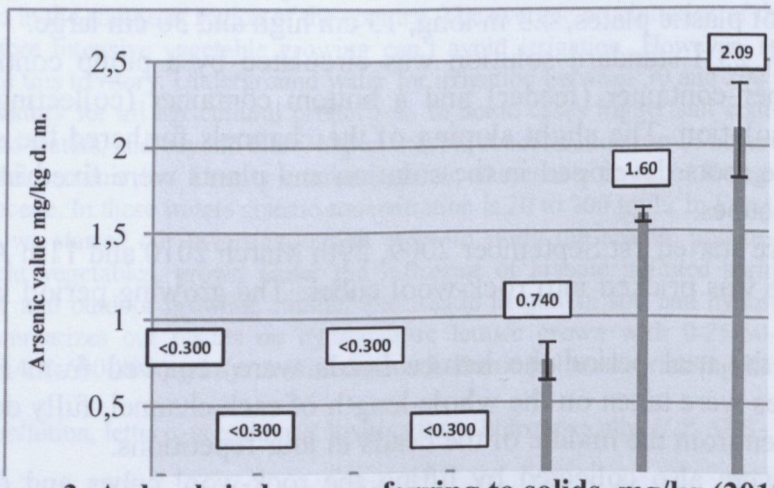

Figure 3. As levels in leaves referring to solids, mg/kg (2011)

As shown by *Figure 2* the 200 µg/L dose in 2009 did not result in measureable As-content in lettuce leaves. Doses 400 and 600 µg/L increased As-content in leaves referring to control and the 200 µg/L dose. Scattering among repetitions is high. The highest As value – 2.67 mg/kg - was found in the third repetition of the 400 µg/L dose. Repetition averages in 400 and 600 µg/L doses were contradictory as the mean of the 400 µg/L dose surpassed that of the 600 µg/L dose (1.56 and 0.952 mg/kg, respectively).

Figure 3 shows our results in 2010. Repetitions showed much less scattering than in 2009. Trials in 2010 indicated a more precise execution of trials. Between the same doses of the two years (200 µg/L) there was considerable difference despite similar conditions. To clear up the situation trial was repeated in 2011 involving all the doses.

The results of our study in 2011 confirmed the experiences of 2010 year. Arsenic content in leaves increased significantly with As doses elevating from 75 to 400 µg/L. in a concentration dependent manner. Arsenic concentration in leaves due to 100 and 200 µg/L concentration were similar. Arsenic doses higher than 400 µg/L did not cause further increase in leaf arsenic concentration, in 2009 and 2011 either.

Analysis of variance showed significant differences in arsenic concentration in leaves after arsenic contamination in sprinkling water in 2010 and 2011. Statistically significant differences (SD<5%) appeared after 75 and 100 µg/L treatments.

Similar trends were observed in the increase of As content in roots in the study years. *Figures 4-6* represent As values in root samples.

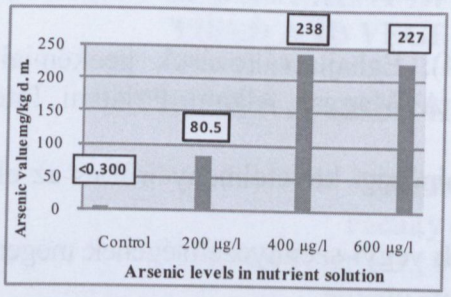

Figure 4. As levels in roots referring to solids (2009)

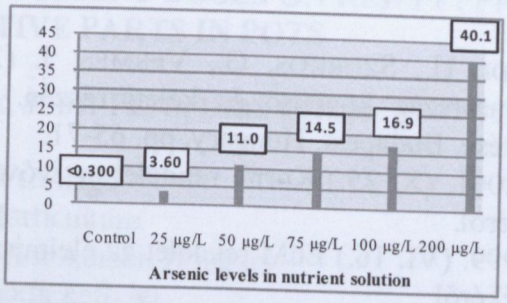

Figure 5. As levels in roots referring to solids (2010)

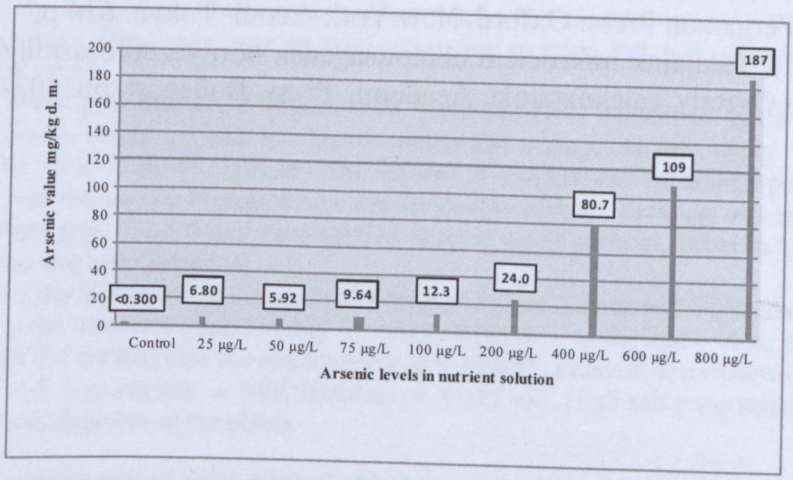

Figure 6. As levels in roots referring to solids (2011)

Increasing As doses increased As concentration in the roots. Low quantities of root samples did not allow repetitions and statistical analysis, yet the physiological filtration effect of the roots is well expressed.

CONCLUSIONS

Trials show that the arsenic concentration of the nutrient solution affects the As content in the vegetative parts of lettuce. Even slight doses (200µg/L) increased As level in the test plant.

Increasing As doses increased As concentration in the roots as well but the accumulation was more accentuated. In some doses As content in roots was 16-89 times higher than in leaves. Results are parallel to those of KÁDÁR (1993) who found 30 mg/kg in roots and 1-5 mg/kg in stems and leaves of the test plants, as affected by As doses. Summarizing it can be stated that the arsenic content of lettuce in original moisture content, grown in hydroculture, increases as affected by As application but it does not surpass the 0.2 mg/kg limit. According to our results even three times higher values than 200 µg/L found in natural well water do not increase the As level above the limit in lettuce.

REFERENCES

FÜGEDI, U., SZURKOS, G., VERMES, J. (2004): Éghajlatváltozások geokémiai hatásai Magyarország középső és keleti részén. In: A Magyar Állami Földtani Intézet Évi Jelentése. Budapest, Hungary. pp. 65-71.

201/2001. (X. 25.) Korm. rendelet az ivóvíz minőségi követelményeiről és az ellenőrzés rendjéről.

17/1999. (VI. 16.) EüM rendelet az élelmiszerek vegyi szennyezettségének megengedhető mértékéről.

BARTHA, A. (2004): Geokémia és geoanalitika: Ritkaelemek, víz és környezetgeokémia. In: Magyar Állami Földtani Intézet évi jelentése. Budapest, Hungary.

FERGUSSON, J.E. (1991): The Heavy Elements: Chemistry, Environmental Impact and Health Effects. Pergamon Press. Oxford–New York–Seoul–Tokyo. 614 p.

KÁDÁR, I. (1993): Talajaink mikroelem ellátottságának környezeti összefüggései. In MTA Agrártudományi Osztály Tájékoztatója. Academic Press, Budapest. pp. 102-106.

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THE EFFECTS OF DIFFERENT NPK NUTRIENT DOSES ON RED PEPPER'S YIELD AND VEGETATIVE PARTS IN POTS

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ABSTRACT

Red pepper (variety 'Hírös') was cultivated in plant pot, in the research garden of Kecskemét College, Faculty of Horticulture. Plant pots were in semi-subsurface position full with sandy soil typical for the Danube-Tisza sand ridges.

Our aim was to investigate changes in productivity, yield and NPK content of leaves in correlation with increased NPK doses on sandy soil with low humus content and average nutrient supply.

We used Hydrofert NPK 15-30-15 fertilizer. The amount of nitrogen and potassium per hectare were 150, 300, 450, 600 kg, and the amount of phosphorus was the double of these. Fertilizer was spread with irrigation into the soil of plant pots. Total doses were applied in three equal portions, between May and July, in all treatments for better nutrient utilization.

Harvest was during the biological ripeness of red pepper, between August and September. Compared to the control samples, yield increased spectacularly in every treatment. At the same time, utilising the highest amount of fertilizer did not decrease the yield compared to smaller amounts. It means we can reach balanced increase of yield with high amount of NPK fertilizer on sandy soil. High salt concentration in the root zone did not hinder the development of the plants.

Keywords: red pepper, nutrient supply, NPK fertilization, NPK content

INTRODUCTION

Soil fertility is a determining factor in agro-ecosystems. Sandy soils with humus typical for the Danube-Tisza sand ridge can be described with poor or average nutrient supply ability. That is why we can observe spectacular increase of biomass and yield as the result of fertilization (HORINKA, 2010).

In this experiment, in relation to our aim was to investigate changes in productivity, yield and NPK content of leaves with increased NPK doses on sandy soil with low humus content and average nutrient supply.

MATERIAL AND METHOD

Our fertilization experiment with NPK nutrients was carried out in the research garden of Kecskemét College, Faculty of Horticulture. Red peppers were planted in 60 cm diameter outdoor plant pots, in semi-subsurface position. Plant pots were full with sandy soil with humus, which is typical for the wider area and the research garden too. The bottoms of the plant pots were open, and they had a sinkhole and a deflector, to avoid stagnant water.

Our investigation was carried out in the growing season of 2012. In early March, we made soil investigations before planting. On the basis of this, the most important parameters of soils in plant plots were the following: K_A= 32; $pH_{(KCl)}$= 7,50; humus%= 2,50 m/m%; $CaCO_3$%= 3,00 m/m%. Phosphorus (P_2O_5) and potassium (K_2O) supply of soils in plant pots was at good and medium level. We had 20 plant pots altogether. Their soil parameters

– which were investigated separately – were similar, so we can assume that the soil of plant pots were homogeneous.

Red pepper (cultivar 'Hírös') planting was carried out on 29th May. Three young plants were planted in one plant pot, so we had three plants in one repetition with every nutrient dose. After planting NPK fertilizer was spread with irrigation into the soil of plant pots. We used Hydrofert (R) (Biochim Hungary Kft. Szeged) NPK 15-30-15 % fertilizer, which is a phosphorus-dominant, up-to-date starter fertilizer. Every treatment had a control, and four uniformly advanced doses, with the following amounts: 150-300-150; 300-600-300; 450-900-450; 600-1200-600 kg ha^{-1}. We had four repetitions for every doses of fertilizer. Total doses were given used in three equal portions, in all treatments for better nutrient utilization, in every four weeks. In this way, nutrient utilization can take place after plantation, in the early flowering and the growing period.

Mechanical and chemical weed controls were applied twice against causative agents. We did not use foliage fertilizer.

We collected plant samples twice, after the growing period. The yield of the first ripening was collected on 23rd August; second harvesting took place on 23rd of September. The total yield amount was cropped, and we measured the wet yield amount. We collected full-grown, whole leaf samples in both harvests, from the middle tierce of foliage.

As part of the investigations we measured the amount of wet yield. Leaf samples were dried, than they were under homogenization and digestion with wet destruction. We determined the total amount of nitrogen, phosphorus, potassium and calcium of leaf samples with Kjeldahl-nitrogen (MSZ-08-0783-6:1983) and ICP-OES methods (HÜVELY, 2005).

RESULTS

We investigated the amount of nitrogen, phosphorus, potassium and calcium amount in the leaf and yield of red pepper. Harvest and collection of leaves took place during the biological ripeness of red pepper, between August and September.

If we investigate the yield of red pepper (*Table 1*), it can be seen, that the impact of increased NPK fertilizer is increased yield, which can be explained by the Mitscherlich principle. It is true especially in case of 150-300-150 kg ha^{-1} treatment, where yield is triple than in control. In other treatments, the increase of yield is less than in other cases. It is confirms results of earlier investigations (CSERNI ET AL., 2008, 2010; NÉMETH, 1996).

Table 1. Yield of red pepper (g) in correlation with NPK treatments

NPK treatment (kg ha^{-1})	yield (g)
0-0-0	209.99
150-300-150	687.02
300-600-300	870.39
450-900-450	1233.38
600-1200-600	1434.35
LSD 5%	268.97

Table 2 shows average values of nutrients in dry matter m/m % in four repetitions. It can be seen that nitrogen content significantly decreases in leaf in case of 150-300-150 kg ha^{-1} NPK fertilizer compared to the control sample. We can explain this with the so called attenuation-effect since bigger biomass results in smaller nutrient concentration. Under 300-600-300 and 450-900-450 kg ha^{-1} treatment nitrogen concentration of leaves shows

minor ascent. In 600-1200-600 kg ha^{-1} NPK treatment, concentration decreases, because of provocative fertilizer dose.

Table 2. Nutrient amounts of red pepper (m/m %) in correlation with NPK treatments

NPK treatment (kg ha^{-1})	N	P	K	Ca
0-0-0	4.08	0.330	0.76	4.64
150-300-150	3.28	0.231	1.51	7.15
300-600-300	3.33	0.222	2.15	7.67
450-900-450	3.44	0.231	2.55	7.20
600-1200-600	3.25	0.216	2.30	7.48
LSD 5%	0.35	0.039	0.74	0.85

Phosphorus content of leaves is demonstrated in *Table 2*. Phosphorus has the least mobility among macro-nutrients. This is the reason of decreased or stagnant phosphorus content despite increase fertilizer doses compared to control samples, because of the attenuation-effect.

Potassium is one of the most important nutrients for red pepper. It has high mobility compared to nitrogen, which means bad potassium supply – as boundary condition – in our experiment on sandy soil with humus.

It can be stated about potassium content of leaf samples on the basis of *Table 2*, that there is no attenuation-effect because of red pepper's high need of potassium. Potassium content of leaves increased in parallel with treatments up to 450-900-450 kg ha^{-1} dose. Decrease of potassium content started only at 600-1200-600 kg ha^{-1} fertilizer level.

It is well known that nutrients with high mobility in larger amount – as nitrogen and potassium – can be found in elderly leaves, but – thanks to mobility – nutrients wander from older vegetative parts to younger leaves and yield. As a result, while the nitrogen concentration of leaves does not increase in parallel with increased NPK doses, balanced ascent is traceable in yield. This effect is more observable in case of potassium, where vegetative parts give more amount of potassium to the yield.

Because calcium is a very important nutrient form for red pepper, too, it is worth investigating the amount of calcium in correlation with treatments (*Table 2*) despite plants have no got calcium in the course of our experiment.

There has been a drastic increase in calcium content of leaf samples compared to the control sample already at 150-300-150 kg ha^{-1} dose. Further increase, then smaller decrease can be detected after that. Mending nitrogen and potassium supply is in the foreground, because higher concentration of macro-nutrients improves calcium uptake from the soil.

CONCLUSIONS

On the basis of data it can be seen that NPK fertilization resulted in significant changes in red pepper yield and nutrient amount of leaves.

LSD 5% values show that difference between averages of treatments – by statistical evaluation – has been caused by treatments. On the basis of this, it can be stated that already 150-300-150 kg ha^{-1} nutrient amount increased both vegetative parts and yield. In case of sandy soils – with poor or medium nutrient supply typical for Kecskemét and its surroundings – nutrient amounts with supplement fertilization cause decrease of NPK

content in leaves only at provocative fertilizer doses (600-1200-600 kg ha^{-1}). Despite this, it can not be traced in yield, which shows contiguous increase.

In the course of our experiment, we substituted lacking precipitation with irrigation – very low amount of precipitation was a strong restrictive factor in outdoor growing in 2012 –, while sun and heat radiation were optimal. In this case, weather conditions were good for red pepper that is why NPK fertilization was the main factor on yield and amount of leaves.

Increased fertilizer doses had influence on the time of ripening; at 450-900-450, and especially at 600-1200-600 kg ha^{-1} treatments not every berries were in ideal ripeness state, time of ripening was longer than in other cases.

In conclusions, we can say – by soil properties typical for this area (high amount of quartz sand, low humus content, bad water balance) – that NPK fertilization with provocative doses does not have adverse influence on yield and development of leaves. Moreover, already 150-300-150 kg ha^{-1} fertilizer dose caused consumedly significant of yield.

REFERENCES

CSERNI, I., PETŐ, J., HÜVELY, A., NÉMETH, T. (2008): Nitrogen, phosphorus, potassium, acid, sugar and vitamin C content in tomato grown in different soil types and under different nitrogen doses. In: VII. Alps-Adria Scientific Workshop, Stara Lesna, Slovakia, 2008. Cereal Research Communications 36supplement(5): 1415-1418.

CSERNI I., RAJKAI K., PETŐ J., HÜVELY A., SZILI-KOVÁCS T., NÉMETH T., KOVÁCS A., RAJKAINÉ VÉGH K. (2010): A nitrogén termésnövelő hatása az étkezési paprika terméstömegére tenyészedényekben, különböző talajtípusokon. In: Agtedu 2010. 11. Tudományos Konferencia. Vol. 1. pp. 69-73.

HORINKA T. (2010): Kertészeti növények komplett tápanyagellátása. Kertészek kis/Nagy Áruháza Kft., Bp. pp. 252-260.

HÜVELY A. (2005): Az ICP, vagyis az emissziós analízis lehetőségei. Magyar Tudomány Ünnepe, Kecskeméti Főiskola. pp. 36-41.

MSZ-08-0783-6:1983. Use of high capacity equipment in plant analysis. Method of chemical preparation of plant samples for the quantitative determination of mineral nutrients.

NÉMETH T. (1996): Talajaink szervesanyag-tartalma és nitrogénforgalma. MTA Talajtani és Agrokémiai Kutatóintézet, Bp. pp. 210-217.

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ECOLOGY AND LANDSCAPE MANAGEMENT EXAMINATIONS IN HUNGARIAN GRASSLANDS

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ABSTRACT
Coenological relevés were already prepared in 1997 on the sandy pastures of Hungary which we repeated in 2005 and 2012. The examinations primarily examined that whether any changes happened in vegetation during test period or not.
Our aim was to determine:
- if any changes happened, what kind of direction did these modify the face of the original vegetation.
- how did it influence the combination of species and how they changed the dominance relations in the associations.
Considerable deterioration between the examinations on the areas cannot be experienced under the examined time. Nevertheless, choosing the appropriate treatment and the correct size of grazing livestock, preservation of the natural conditions is possible on both sites.

Keywords: coenological relevés, pasturage, forage value, grass constituent

INTRODUCTION

In Hungary 5.8 million hectares is and approximately 1 million hectares is grassland (HUNGARIAN STATISTIC CENTRAL, 2012). In Hungary 256 674 hectares are under nature protection. In the conservation of thesearea the grazing animal husbandry has a determinative role. It is highly important to harmonise aims and tasks of agriculture and nature conservation in these areas. Overgrazed parts have already been transformed into degraded ruderal areas and grasslands became even poorer in species (ANTAL AND HUZSVAI, 2007). The composition of dominant species in grasslands further away from the summer lodging has not changed significantly. Values of meadows and pastures (natural conservation, lawn farming and forage doctrine) highly depends which is determined by the proportion of useful, less useful and other races. For the accurate knowledge of the species composition of the lawns number of authors justifies the importance of the grazing (SZEMÁN, 2007).

MATERIAL AND METHOD

The examinations were made in three different groups. Intensive grazing area placed (0–50 m) on the other side of fenced area where the fold was built (group A). Grazed area (50–150 m) is grazed by a few animals and this belongs to the second (B) group. Area placed farther than 150 meters belongs to the third (C) group. Coenological investigations were prepared according to BRAUN–BLANQUET (1964) by using 2×2 m quadrates. Among relative ecological values: water demand (WB) and nitrogen demand (NB) values were evaluated according to BORHIDI (2005). Evaluation of social behaviour types were made according to BORHIDI (2005) as well. The natural conservation categories were determined based on Simon's classification. A ten grades scale was created to define the forage value of

the important plant species found in the lawn KLAPP ET AL. (1953). The most valuable species got number 8 the worthless ones which were not grazed by animals got 0 while the poisonous species got -1.

Fodder value of lawns based on the next formula: TÉ= [(a·A+b·B+c·C...)/100] x

TÉ: The fodder value of the lawn.
a, b, c...: The fodder value categories of the species.
A, B, C...: The cover of the species.
x: All of the covers of the species.

RESULTS

The social behaviour types of species

Rate of natural disturbance tolerant (DT) and ruderal competitors (RC) species were high near the farm and observable rate of weeds (W) increased. The natural pioneer (NP) species had roughly identical proportion in all three examination years *(Figure 1)*. Natural competitors (C), generalist (G) and specialist (S) species decreased and they disappeared under thirteen years. The proportion of the ruderal competitors (RC) decreased in the farther areas however, the natural disturbance tolerant species (DT) were in a big proportion on a sign here. The aggressive competitors (AC) species appeared in a no significant rate in the 2005 in the first and the third category *(Figure 2)*. Natural competitors (C), generalist (G) and specialist (S) species in the area 0–50 m and in area 50–150 m spreading category represented a more considerable proportion *(Figure 3)*.

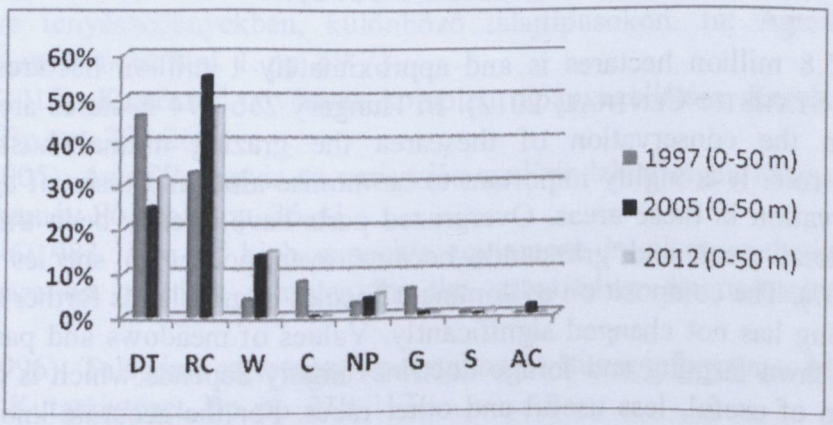


Figure 1. The social behaviour type values between 1997 and 2012 (0–50 m)

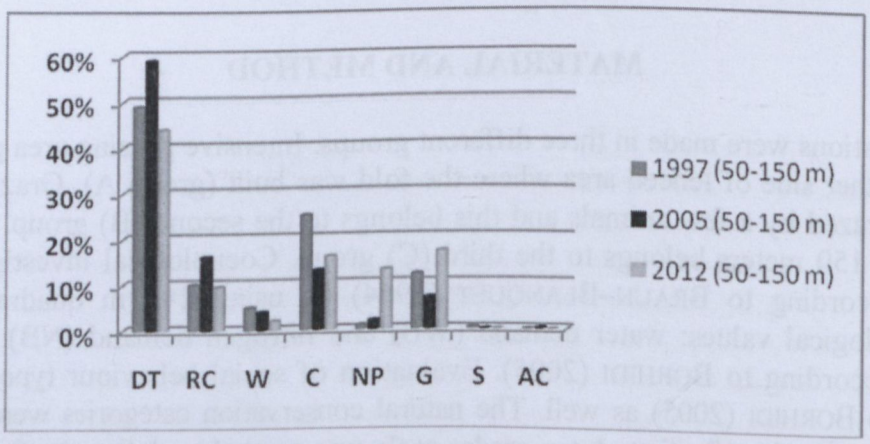


Figure 2. The social behaviour type values between 1997 and 2012 (50–150 m)

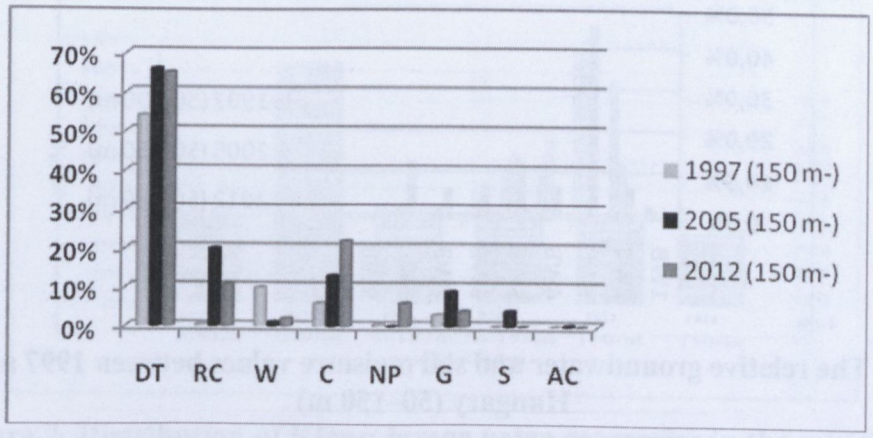


Figure 3. The social behaviour type values between 1997 and 2012 (150 m-)

The relative groundwater and soil moisture

Drought tolerant plant species and plants of occasionally fresh cropland had the highest coverage rate in the area near the farm in all three years. Semi-wet habitats indicator species appeared in an outstanding percentage. It's worthy to mention the rate of typical plants of medium dry places was 7–18%. The dryness tolerant plant species and plants of occasionally fresh cropland were in largest proportion receding from the farm. The number of the dryness tolerant plants in the 50-150 m spreading area category increased significantly and the plants typical of medium dry places and semi-wet habitats indicator species were in an equal quantity *(Figure 4)*. In this category in they were around 10% in 1997 while the moistness attribute plants disappeared till 2010 totally. Plants belong to the third category were in a largest proportion in the areas farthest from the farm *(Figure 5)*. Plants were typical of medium dry places and semi-wet habitats indicator species show an identical fluctuation in all three examination periods *(Figure 6)*.

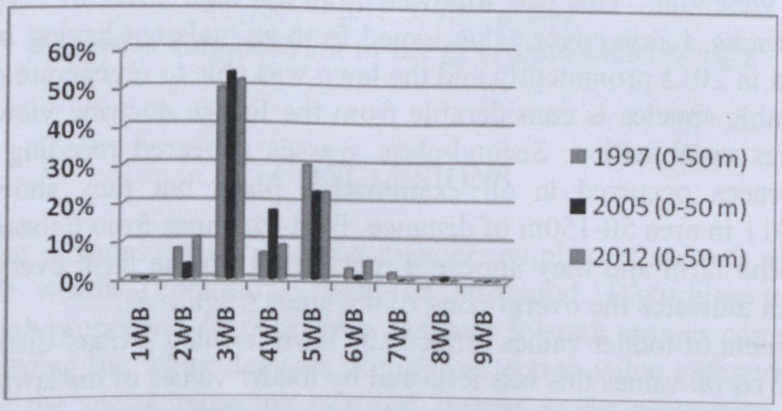


Figure 4. The relative groundwater and soil moisture values between 1997 and 2012 in Hungary (0–50 m)

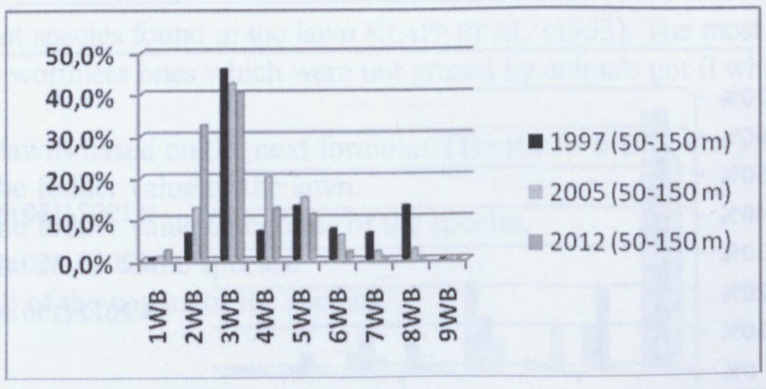


Figure 5. The relative groundwater and soil moisture values between 1997 and 2012 in Hungary (50–150 m)

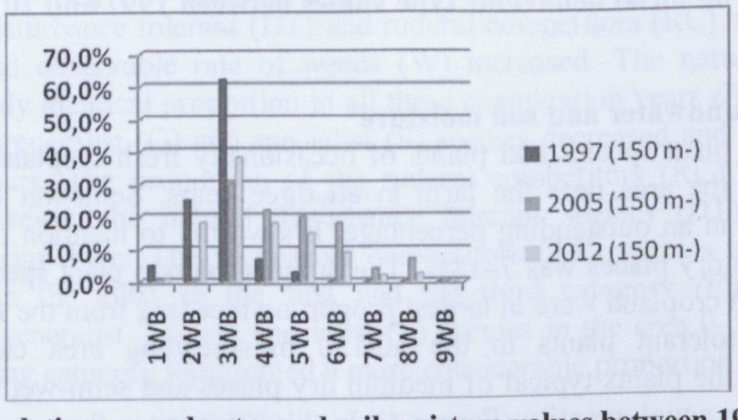


Figure 6. The relative groundwater and soil moisture values between 1997 and 2012 in Hungary (150– m)

Forage values of examined grasslands

Species composition of the lawn near the animal husbandry farm appeared valuable from a forage doctrine viewpoint. This was followed from the high cover of *Elymus repens* and *Festuca arundinacea.* Large cover value issued from animals not having been shepherded out onto the area in 2012 prominently and the lawn was able to regenerate *(Figure 7)*. Rate of the less valuable species is considerable from the forage doctrine viewpoint based on examined species combination. Second-class grasses appeared receding from the fold. Tertiary grass races occurred in all examination place but they showed the largest proportion in 2011 in area 50-150m of distance. First-rate ones from Fabaceae family were missing beside the farm and they appeared receding from the farm everywhere in a big proportion which indicates the overgrazing of the areas *(Figure 8)*.

Klapp establishment of fodder values reflects the lawn farming groups' distribution. Largest values were near corral values this was followed by fodder values of the lawns in the area 50-150 m of distance (*Table 1*) while farther areas had the smallest values.

Table 1. Forage values of examined grasslands in 2011-2012

	Distribution of Klapp forage value of examined grasses					
	2011	2012	2011	2012	2011	2012
Distance (m)	0-50	0-50	50-150	50-150	150-	150-
Value	1.82	6.89	1.58	1.25	0.54	0.78

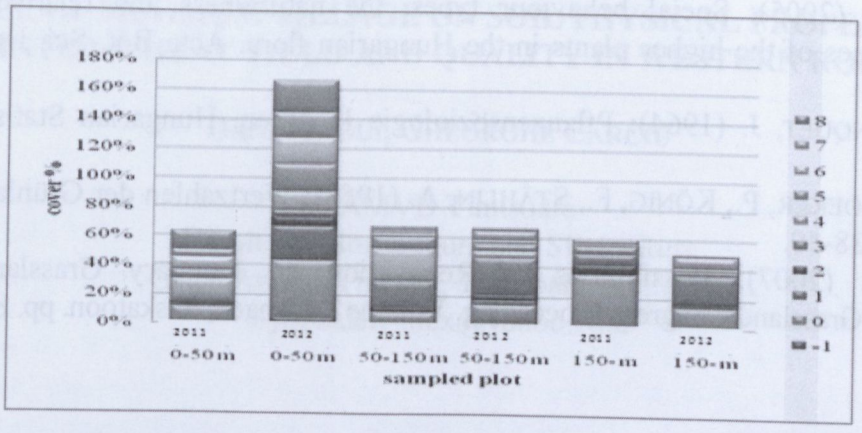
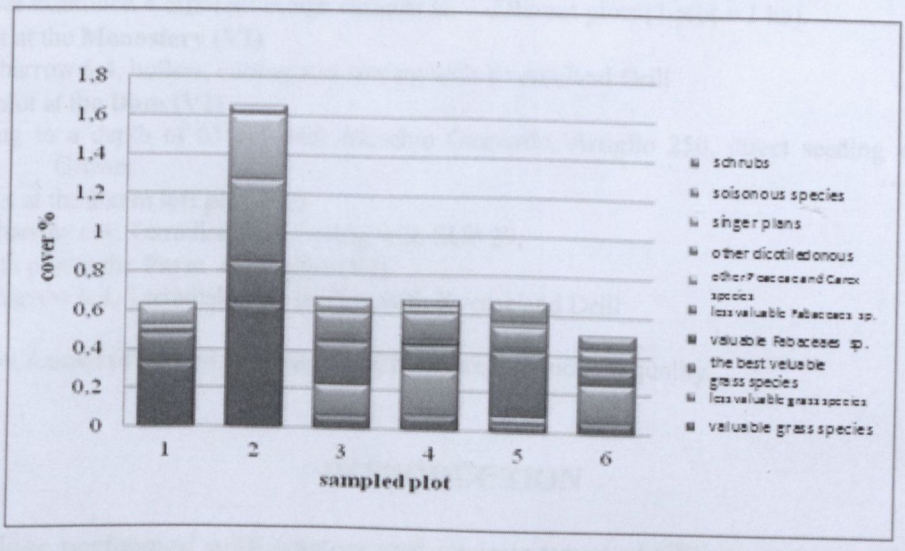


Figure 7. Distribution of Klapp forage value categories in the grassland



Sampled plot and time: 1: 0–50 m 2011; 2: 0–50 m 2012; 3: 50–150 m 2011; 4: 50–150 m 2012; 5: 150– m 2011; 5: 150– m 2012

Figure 8. Composition of the grassland (2011–2012)

CONCLUSIONS

Single protruding changes for the keeping manner, number of animals and in the given year for typical weather conditions could be attributed. Disturbing tolerating weeds appeared in a high proportion near the farm. Dryness tolerant species came forward in the largest rate regarding the water demand. Nature protection value categories followed the establishment of the social behaviour types of species in the proportion of the waitings adequately.

REFERENCES

ANTAL, ZS., HUZSVAI, L. (2007): Grass production model based grazing as the sustainable utilization of protected grasslands. Cereal Research Communications 35: 189-192.

BORHIDI, A. (2005): Social behaviour types, the naturalness and relative ecological indicator values of the higher plants in the Hungarian flora. Acta Bot. Sci. Hung. 39: 97-181.

BRAUN-BLANQUET, J. (1964): Pflanzensoziologie II. Wien. Hungarian Statistic Central, 2012

KLAPP, E., BOEKER, P., KÖNIG, F., STÄHLIN, A. (1953): Wertzahlen der Grünlandpflanzen. Grünland 2: 38-40.

SZEMÁN, L. (2007): Possibilities of Renovation on Hungary Grasslands. XVIII. International Grassland Congress Proceeding. Volume 2. Canada, Saskatoon. pp. 83-84.

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INFLUENCE OF MINIMUM TILLAGE ON SOIL PHYSICAL PROPERTIES AND ON WINTER WHEAT YIELD AND QUALITY IN WESTERN ROMANIA

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ABSTRACT

Research was carried out between October 1, 2011 and September 31, 2012 and focused on the following aspects:

- influence of minimum tillage on soil physical properties in the experimental field located in the village of Sag, where we examined 4 different tillage variants on 4 different plots (1 plot = 1 ha).

- First plot at the **Monastery (V1)**
  2X disc harrow 6.4, hollers, cutting and sowing with Kverneland Drill
- Second plot at the **Dam (V2)**
  Subsoiling to a depth of 65 cm with Maschio Gaspardo, Artiglio 250, direct seeding with Terramix Grower
- Third plot at the **Farm left plot (V3)**
  2X disc harrow 6.4, Terradisk 500, sowing with SUP 29,
- The fourth plot at the **Farm right plot (V4)**
  2X disc harrow 6.4, Terradisk 500, seeding with Kverneland Drill

Keywords: minimum tillage, winter wheat, soil moisture, production, quality.

INTRODUCTION

The soil tillage performed with tractors and various types of tillage equipment has harmful effects on soil characteristics, such as degradation of soil structure, compaction of surface and depth, low humus content, reduced biological activity which ultimately lead to lower natural fertility of the soil (GUŞ ET AL., 2003).

The economical efficiency of a culture is in strong connection with the way of performance and the quality of the tillage systems (DUMITRU ET AL., 1999). The tillage systems determine firstly changes of the physical characteristics which influence the chemical and the biological features of soil.

Modernization of agriculture in the last decades has come with a number of harmful effects on soil physical properties and on the environment (CANARACHE, 1990). We use increasing levels of fertilizers, especially the chemical ones, because we want to increase the amount of production and reduction of cultivated area (DERPSCH , 2001).

The product quality was also followed with great attention and therefore only varieties which resist to the climatic conditions specific for the cultivated area has been grown (MATEESCU, 2003).

The conservation and maintenance of natural fertility of the soil was and it is promoted by researchers and specialists with the current requirements of sustainable agriculture.

It is not surprising that all the countries are looking for extensive research in agronomical, technological, design and especially tillage techniques in the hope of finding new ways of saving energy and money (ŞARPE, 2001).

MATERIAL AND METHOD

Table 1 shows the 4 types of minimum tillage used in Sag area in all 4 plots (1 plot = 1 ha). The most important components of conservative technological systems, as in the case of conventional tillage, are the tillage variants and the seed input method (ŢOPA AND JITAREANU, 2007).

To this end, soil samples were taken from all 4 plots, where soil profiles were made at an average depth of 50 cm, to determine and compare soil texture, soil structure, soil moisture, soil porosity, degree of compaction, etc.

After we have collected 4 soil samples from every 10 cm to a depth of 50 cm on all 4 plots, we determined the specific weight of the wet soil samples. Then the samples were incubated for 10 hours at 102 °C and were weighed again using digital balance. To obtain accurate results, we used digital balance to measure the soil moisture directly in the field as we can see in *Table 7.*

We have performed measurements on straw weight (10 repetitions/plot), length and number of grains/straw.

Table 1. Soil tillage work on the experimental plots of the Sag locality

Work performed	Monastery (V1)	Dam (V2)	Farm Left Plot (V3)	Farm Right Plot (V4)
Seedbed preparation 2011	2X disc Harrow 6.4, rollers, cutting, sowing with Kverneland Drills	Subsoiling to a depth of 65 cm with Maschio Gaspardo, Artiglio 250 Direct seeding with TERRAMIX Grower	2X disc harrow 6.4, TERRADISK 500 Sowing with SUP 29	2X disc harrow 6.4, TERRADISK 500 Seeding with Kverneland Drill
Forecrop 2010	Sunflower	Wheat	Wheat	Wheat

RESULTS

As it can be seen in the following tables, according to the tillage method, we have production and quality differences, considering that all four plots were cultivated with the same variety of winter wheat, variety 'Alex Basis'.

Table 1 shows the 4 types of minimum tillage used in Sag area.

Table 2. Number of plants raised per square meter 2011-2012

Variant of soil work	Number of raised plants/m^2	Relative values (%)	Differences plants/m^2	Significance of differences
V_2 –	560	104,09	+22	***
V_4 -	550	102,23	+12	***
V_1 –	540	100,37	+2	-
Average $\bar{x}$	538	100,00	Mt.	-
V_3 -	502	93,39	-36	000

Dl 5% = 5,12 plants/m^2 ; Dl 1% = 7,93 plants/m^2; Dl 0,1% = 10,03 plants/m^2

If we look at *Table 2*, at the plot Dam (V2), we have obtained the best results.
Table 3 shows that at the plot Monastery (V1) the average wheat grain weight is the highest with a value of 1.25 g and the minimum average wheat grain weight is at the Farm Left Plot (V3) with a value of 1.14 g.

Table 3. Influence of soil tillage on wheat grain straw weight in 2011-2012

Variant of soil work	Grain weight (g)/straw	Relative values (%)	Differences (g)	Significance of differences
V_1 –	1.25	105.04	+0.06	-
V_2 –	1.24	104.20	+0.05	-
V_3 -	1.14	95.80	-0.05	-
V_4 -	1.11	93.28	-0.08	-
Average $\bar{x}$	1.19	100.00	Mt.	-

Dl 5% = 0,12 g/straw ; Dl 1% = 0,24 g/straw ; Dl 0,1% = 0,42 g/straw

In *Table 4* we can see the influence of soil tillage on wheat straw weight and we can observe that the best results were obtained at the Monastery plot (V1) with an average of 1.66 g after 10 repetitions. The minimum value is obtained at the Farm Left Plot (V3) with an average weight of 1.10 g after 10 repetitions.
Table 5 shows the influence of soil tillage on wheat quality with the following parameters:
- humidity (%) with values between 12.5 % and 14 %,
- hectolitre weight (kg/hl) with values between 76.5 (kg/hl) and 79.8 (kg/hl).

In *Table 5* we present qualitative evidence to the culture of wheat on the 4 plots, results obtained with the device GRANOMAT.

Table 4. Influence of soil tillage on wheat straw weight in 2011-2012

Repetition	Wheat straw weight (g)			
	Monastery (V1)	Dam (V2)	Farm Left Plot (V3)	Farm Right Plot (V4)
1	2.04	1.40	0.84	1.33
2	1.78	1.58	0.99	1.60
3	2.17	1.03	1.25	1.07
4	2.00	2.06	1.25	1.29
5	1.56	1.20	1.44	1.24
6	1.25	1.12	1.25	1.43
7	1.76	1.60	1.19	1.95
8	1.97	2.19	0.94	1.25
9	0.69	1.45	0.99	1.17
10	1.44	1.75	0.93	1.17
Average	**1.67**	**1.54**	**1.11**	**1.35**

Table 5. Influence of soil tillage on wheat quality in 2011-2012

Quality parameters	Monastery (V1)	Dam (V2)	Farm Left Plot (V3)	Farm Right Plot (V4)
Humidity (%)	13.9	12.5	14.0	13.5
Hectolitre weight (kg/hl)	76.5	79.9	77.5	77.7
Temperature (°C)	26.5	26.7	26.2	25.4

In *Table 6* we have presented the qualitative evidence to the culture of wheat on the 4 plots, results obtained with the device OMEGA ANALIZER in 2011-2012 with protein content values between 10.5% and 13.1%, gluten content with values between 12% and 21%, and Zeleny index with values between 17 ml and 41 ml.

Table 6. Influence of soil tillage on wheat quality in 2011-2012

Quality parameters	Monastery (V1)	Dam (V2)	Farm Left Plot (V3)	Farm Right Plot (V4)
Protein content (%)	12.5	13.1	10.7	10.5
Humidity (%)	13.6	12.1	13.5	13.6
Gluten content (%)	20.0	21.0	13.0	12.0
Sedimentation value (Zeleny index)(ml)	41.0	38.0	17.0	17.0

In *Table 7* we presented the humidity values taken directly in field with the electronic balance at 01.10.2011 which has a major influence on the quality and quantity of winter wheat.

Table 7. Soil humidity registered on the 1. October 2011 in the depth of 0-50 cm

Depth profile	Soil moisture (%)			
	Monastery (V1)	Dam (V2)	Farm Left Plot (V3)	Farm Right Plot (V4)
0-10 cm	21	15	10	21
10-20 cm	25	18	16	22
20-30 cm	28	22	21	25
30-40 cm	31	25	27	29
40-50 cm	32	33	30	35

Table 8 presents the production of winter wheat in 2011-2012 on all 4 plots.

Table 8. Production of winter wheat in 2011-2012 (q/ha)

Variant of soil work	Production (q/ha)	Relative production (%)	Production difference (q/ha)	Significance of differences
V_2	48.80	105.67	+2.62	*
V_1	46.60	100.91	+0.42	-
V_3	45.50	98.53	-0.68	-
V_4	43.80	94.85	-2.38	0
Average $\bar{x}$	46.18	100.00	Mt.	-

Dl 5% = 2,28 q/ha ; Dl 1% = 3,16 q/ha ; Dl 0,1% = 4,35 q/ha

CONCLUSIONS

The reduction of the soil structure and the physical characteristics are the first changes induced by the tillage systems. The minimum tillage systems, through the reduction of the soil tillage and by the increase of the quantity of organic matter left in the soil or on its surface contribute essentially to the renewal of the soil structure (BUDOI, 1997).

The total porosity offers significant information about many soil characteristics. High values of the total porosity show a higher capacity of water storage, high permeability and good airing, but sometimes reduced values of the lifting power (STĂNILĂ, 2000).

The porosity variations, induced at the conventional and unconventional works for the soil preparation are not uniform on the profile and more they do not influence all pore categories (CARCIU, 2003)

Considering the amount of rainfalls in 2011, with an average of 768.90 mm, we can tell that it was a favorable year for wheat crop.

The soil porosity can be damaged seriously due to the improper application of the soil tillage systems. The soil humidity taken directly in field with the electronic balance has a major influence on the quality and quantity of winter wheat.

Our results show that at the Plot Dam (V2) where we have made the subsoiling to a depth of 65 cm, we had the best wheat yield of 48.80 q/ha.

REFERENCES

BUDOI, GH. (1997): Lucrările solului componentă de bază a sistemului de conservare a solului, în "Simpozionul Naţional de Lucrări Minime ale Solului", Cluj-Napoca. pp. 238-239.

CANARACHE, A. (1990): Fizica Solurilor Agricole, Ed. Ceres Bucuresti. pp. 9-10.

CÂRCIU, GH. (2003): Agrotehnica, Ed. Agroprint, Timişoara. pp. 116-117.

DERPSCH, R. (2001): Keynote: Frontiers in Conservation Tillage and Advances in Conservation Practice. In: Stott, D.E., Mohtar, R.H., Steinhardt, G.C. (eds): Sustaining the Global Farm - Selected Papers from the 10th International Soil Conservation Organization Meeting held May 24- 29, 1999 at Purdue University and the USDS-ARS National Soil Erosion Research Laboratory. pp. 248-254.

DUMITRU, E., ENACHE, R., GUŞ, P., DUMITRU M. (1999): Efecte remanente ale unor practici agricole asupra stării fizice a solului, Studiu de caz în jud. Timiş, Ed. Risoprint, Cluj-Napoca. pp. 51-52.

GUS, P., RUSU T., STANILA S. (2003): "Lucrările neconvenţionale ale solului şi sistema de maşini", Ed. Risoprint, Cluj-Napoca. pp. 32-33.
MATEESCU, M. (2003): Tehnici şi tehnologii folosite la semănatul cerealelor păioase în sistem conservativ al solului. Rev. Mecanizarea Agriculturii, nr.3. pp. 13-14.
ŞARPE, N. (2001): Cultura grâului de toamnă în teren nearat "no-tillage", tratat cu erbicide, în "Agricultura României" anul XII, nr.38 (559). pp. 72-73.
STĂNILĂ, S. (2000): Cercetări privind optimizarea procesului de prelucrare a solului cu minimum de lucrări în vederea reducerii consumului energetic, Teză de doctorat, Cluj-Napoca. pp. 55-56.
ŢOPA, D., JITAREANU, G. (2007): „Influenţa sistemelor de lucrare a solului asupra categoriilor de porozitate la cultura grâului de toamnă", Compactarea solurilor – procese şi consecinţe, Ed. Risoprint, Cluj-Napoca. pp. 125-126.

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BIOGAS EXPERIMENTS WITH PIG SLURRY AND MUSHROOM COMPOST WITH CORN SILAGE

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ABSTRACT
Mushroom growing is a sector of the national horticulture and the compost production is an essential part of the technology. The mushroom compost production is an environmental activity, because there is an opportunity in economical processing of big quantity of agricultural by-products. The mushroom compost contains chicken manure, straw, peat, yielded mushroom residue (residual stump, mycelium, mushroom) and sometimes horse manure. During the technology the quantity of ammonia emitted by the firms and the odour emission and the stench contamination is a serious problem. The large-scale manure production modelling of biogas experiments used liquid pig slurry as raw material. The additives were bran, mushroom compost and maize silage. The industrial by-products and wastes suitable for biogas production are defined by the dry matter, organic matter, nitrogen content, C:N ratio, specific gas yield. The intensity of the methane production is the direct measure of the activity of the methanogenic bacteria, and the most sensitive, typical indicator of the digester's yield. The combination and the yield of the produced gas features may be useful to estimate the stability of the anaerobic system. Consequently, the results of the examinations bring practical profit on the sizing, investment and firm operational area indispensable.

Keywords: organic matter decomposition, gas yield, methane content

INTRODUCTION

An energetic aim of the utilisation of the manure meaning serious environmental load with other wastes and by-products of a certain micro-region may increase the profit-making ability of agricultural investments. The economical operation of the pork breeding claims the increase of the firm size especially, which may entail the considerable growing of the environment-damaging effects (GOTTSCHALK, 1979). The multiple beneficial effects of the biogas production (energy production + environmental protection investment + biomanure production + the treatment of hazardous waste and its utilisation) are expounded if the possible power generating ability of the co-ferment is modelled similar to operating circumstances on an experimental way beforehand (GERARDI, 2003). The research of appropriate technology may decrease the time of fermentation, the measure of the demolition may improve and the methane content of the forming biogas may grow.

MATERIAL AND METHOD

The large-scale manure production modeling of biogas experiments used the liquid pig slurry as raw material. The additives were mushroom compost and maize silage, the recipe of the co-ferments and the dry matter content of the substrate is in *Table 3.* The industrial by-products and wastes suitable for biogas production were defined by the dry matter, organic matter, nitrogen content, C:N ratio and specific gas yield.

The technology of the fermentation experiments

At the Engineering and Agricultural Faculty of the College of Szolnok there is an appropriate, semi-automatic experimental system, representing the operating circumstances, providing similar conditions suitable for the formation process of the biogas, regulating the change of influencing factors and provide the opportunity of all the necessary measurements of typical data. The liquid pig manure was used during our biogas production experiments as basic substance. The research of appropriate technology may decrease the time of fermentation and the rate of the decomposition may improve and the methane content of the forming biogas may grow.

The supreme features of industrial by-products and wastes suitable for biogas production:

- dry matter,
- organic matter,
- nitrogen content,
- C:N proportion,
- specific gas yield.

The technology of fermentation experiments, the process of the experiment series:

a) loading of laboratory digesters, setting of the treatment combinations
b) sampling
c) measurements, examined parameters

We may split the process of the fermentation into sections according to the *Table 1.*

Table 1. The parameters measured during the experiment series, measuring devices, methods, frequency

Serial number	Measured parameter	Device	Method	Comment
1.	fermentor temperature (°C)	digital thermometer		once a day, at the same time
2.	gas yield (dm^3)	gas meter		
3.	gas content (%)	GA45 gas analyser		
4.	conductivity (mS/cm)	Hydrolab	electrometry	once a day, at the same time
5.	soluted oxigen (mg/l)			
6.	pH			
7.	salination (PSS)			
8.	redoxpotential (mV)			
9.	BOD5 (mg/l)	Oxi Top 110	pressure dropping	from samples selected based on professional view points
10.	COD (mg/l)	NANOCOLOR	photometry	
11.	dry matter content (%)	drying cupboard		once a day, at the same time

We can dose ~50 dm^3 of liquid dung mixture pro treatment to take the factors in connection with the capacity of the fermentors into account. It is possible the simultaneous examination the effect of 9 treatment combinations with in a heat able room placed, periodically mixed, hermetically closed fermentors. We applied the continuous (filling up), mezophilic system, which is most widespread in the practice. The process sections, such as the launching, load change, receipt change can be reproduced, according to certain expert's opinions each single daily measurement combination for a separate experiment can be qualified (KALMÁR ET AL., 2003).

We divided the process of the fermentation into sections according to *Table 2.*

Table 2. Technology of the co-fermentation experiments

Serial number	Period of the process	Treatment	Duration time
1.	stabilization	running-up period with fresh substance	7 days
2.	refilling period with fresh substance		14 days
3.	running-up period		21 days
4.	comparative experiments		21 days

The biogas production depends on changing the quality of the liquid pig slurry basis during the fermentation process, that's why it is necessary to use control experiments with pure pig slurry with different dry matter content (ARTHURSON, 2009)*(Table 3).*

Table 3. The dry matter content and composition of the daily treatment of fermentor

	Control I. (liquid pig slurry)	Control II. (liquid pig slurry)	100 g/(MC:CS=75:25)	100 g/(MC:CS=50:50)
Average dry matter content (%)	3.40	4.59	3.99	3.96

MC: yielded mushroom compost; CS: corn silage

The statistical methods used

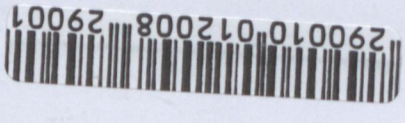
For the statistical analysis Excel spreadsheet and SPSS for Windows 18.0 were used. The data were analysed by variance with independent two-T sample. The homogeneity was examined with Levene test. By the group pair comparison, Tamhane test was used in the case of heterogeneity and LSD test in the case of homogeneity. The relationship between variables was performed with correlation analysis tests (Pearson's correlation coefficient) and linear regression analysis.

RESULTS

The results of the experiments of mushroom compost and corn silage additives with liquid pig slurry co-fermentation are displayed in *Table 4.* The other gases (hydrogen sulfide, ammonia, etc) reduce large-scale application conditions.

Table 4. Average gas yield of liquid pig slurry basis, mushroom compost (MC) and corn silage (CS) added

Load of fermentor	Dry matter content (%)	Gas releasing (Ndm^3/day)	Methane content (%)	CO_2 content (%)	Average methane releasing (Ndm^3/day)	Gas releasing, referred to fermentor volume unit (Ndm^3/dm^3/day)	
						biogas	methane
Control I.	3.40	16.98	58.92	26.5	14.5	0.30	0.20
Control II.	4.59	23.04	59.07	30.6	10.3	0.41	0.26
100 g/(MC:CS=75:25)	3.99	74.47	48.86	37.4	13.7	1.49	0.73
100 g/(MC:CS=50:50)	3.96	58.16	40.42	30.9	28.7	1.16	0.47



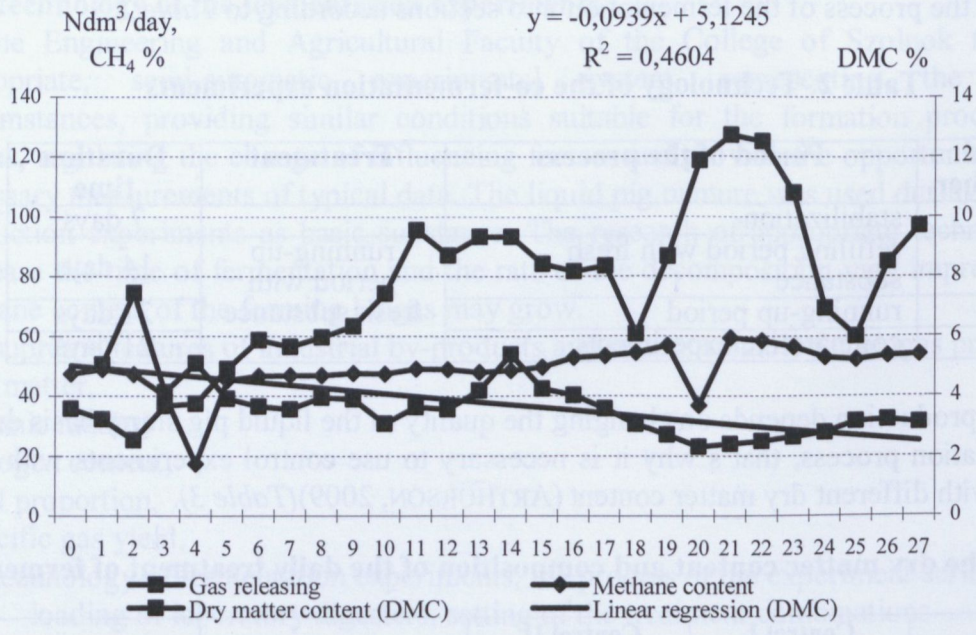


Figure 1. Evolution of parameters in the mushroom compost - corn silage (MC/CS=75:25) experiment (100 g dry matter/day)

The changing trend of dry matter content can be described by the y = -0.0939 + 5.1245 x function in the case of the daily 100 g dry matter, MC:CS ratio = 75:25 yielded mushroom compost – corn silage addition (R^2 = 0.4604). The co-fermentation can work with 74.47 Ndm^3/day average biogas production in a sustainable way *(Figure 1).*

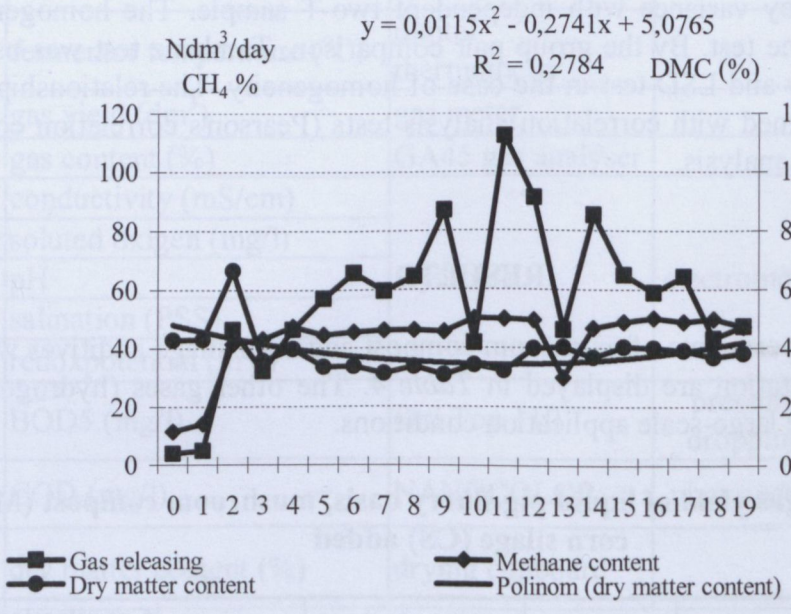


Figure 2. Evolution of the parameters in the mushroom compost - corn silage (MC/CS=50:50) experiment (100 g dry matter/day)

The changing trend of dry matter content can be described by the y = 0.0115 x^2, - 0.2741x + 5.0765 x function in the case of the daily 100 g dry matter, MC:CS = 50:50 yielded mushroom compost - corn silage co-ferment addition (R^2 = 0.2784). The co-fermentation works *(Figure 2)* with 58.16 Ndm^3/day average biogas production and only an average of 40.42% methane content.

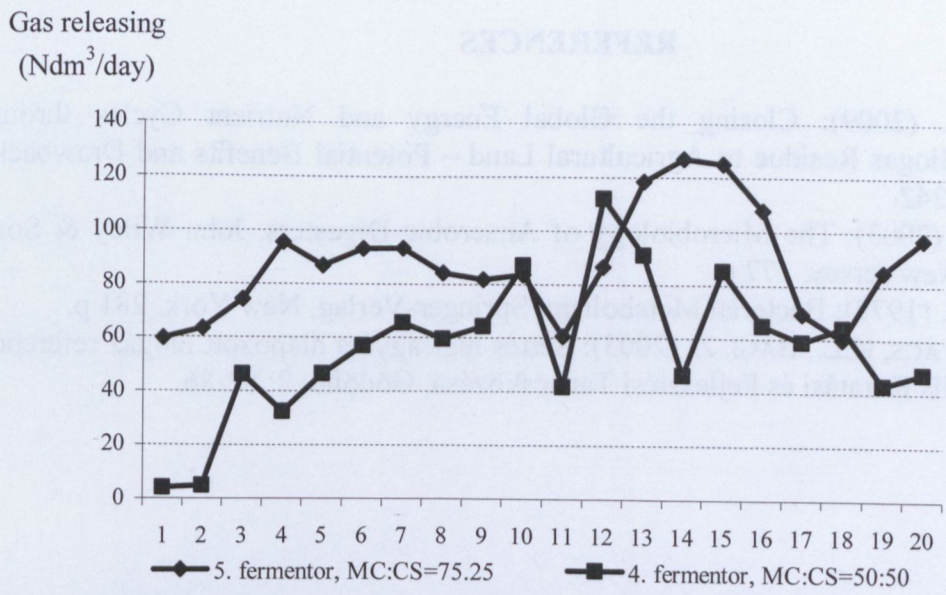


Figure 3. Gas formation trends in the 4th fermentor (MC:CS = 50:50) and in the 5th fermentor (MC:CS = 75:25)

Dry matter content (DMC): 0.20-0.22% dose/day, 4% DMC containing of liquid pig slurry basis

The experiments show that the by-products used as additives significantly increased the low dry matter content of organic material of liquid pig slurry, but with the exception of the 50-50% recipe, did not reduce the methane content of biogas *(Figure 3)*. The different yield increasing impact of the different additives may be caused by the different C/N ratio of them. The parallel fluctuations in the methane have various technological reasons.

CONCLUSIONS

The impact of the additive composition on the average daily gas production differs significantly. The reason could be the different C/N ratio of the different additives and the degradability of the different components. The production of 100 g of dry matter quantity, in a 75% mushroom compost and 25% corn silage containing biogas system in relation to five times the biogas, methane production in relation to 3.6-fold in the same dry matter content compared to controls. 100g dry matter quantity, 50% mushroom compost and biogas system containing 50% corn silage in biogas production in relation to 3.7-fold, 2.7-fold relative to methane production in the same dry matter content compared to controls. The gas production and methane content of the biogas yielded by the 50% maize silage and 50% mushroom compost differed significantly. The cause could be the inappropriate homogeneity of the silage. The system failed to reach an average methane content of 50% and greatly increased the amount of other gases. In addition to corn silage, chop conditions can also affect starch fermentation. The mushroom compost environment, the bigger, less deconstructable silage corn chaff size of bigger proportion produced biogas with lower methane content. This can be utilized with properly converted burners for direct heat production or for example in micro-turbine electric power generation, too.

REFERENCES

ARTHURSON, V. (2009): Closing the Global Energy and Nutrient Cycles through Application of Biogas Residue to Agricultural Land – Potential Benefits and Drawbacks. Energies 2: 226-242.

GERARDI, M.H. (2003): The Microbiology of Anaerobic Digesters. John Wiley & Sons, Inc., Hoboken, New Jersey. 177 p.

GOTTSCHALK, G. (1979): Bacterial Metabolism. Springer-Verlag, New York. 281 p.

KALMÁR, I, KOVÁCS, K.L., BAGI, Z. (2003): Sertés hígtrágyára alapozott biogáz referencia üzem. MTA AMB Kutatási és Fejlesztési Tanácskozása. Gödöllő, 2: 82-86.

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